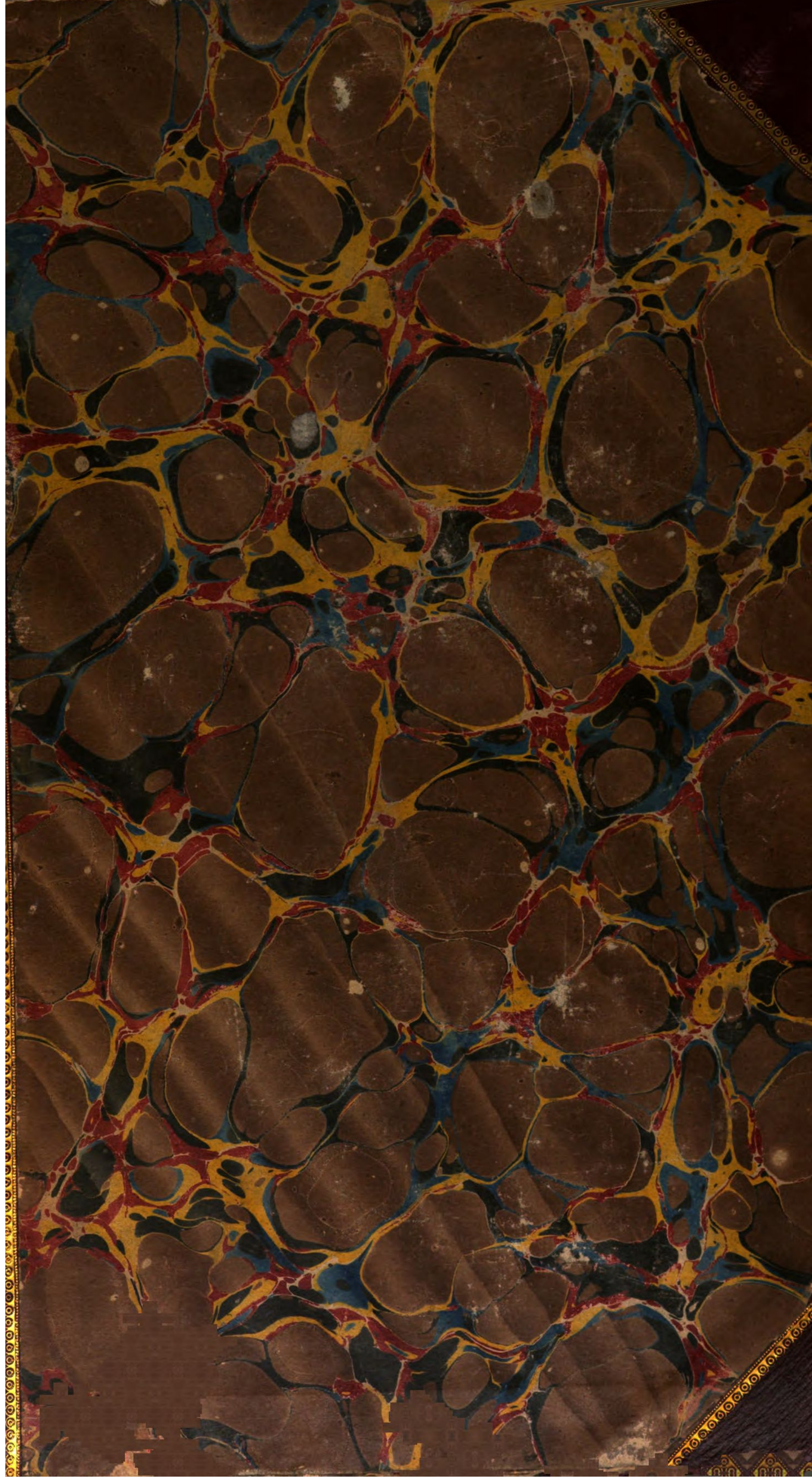
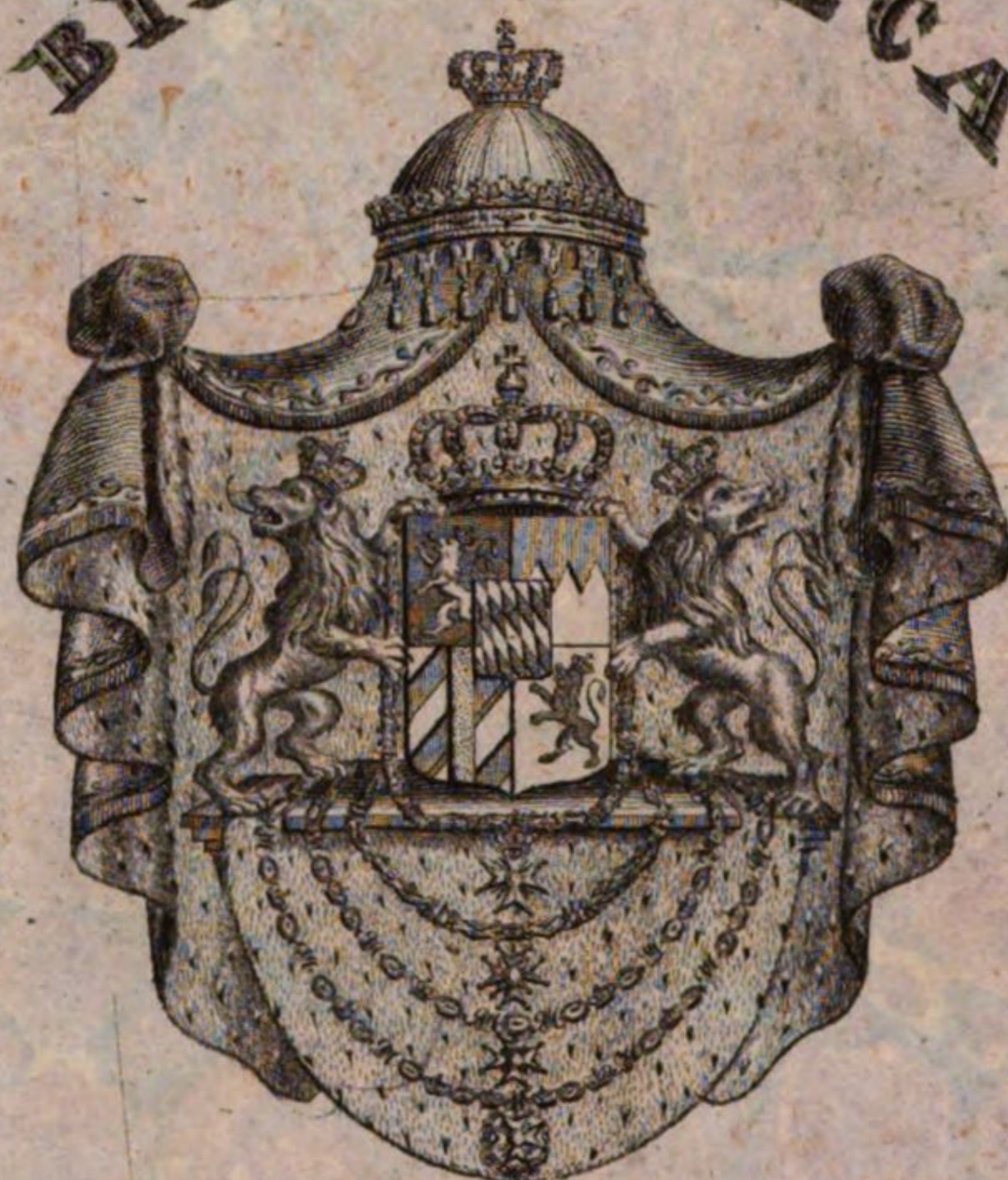
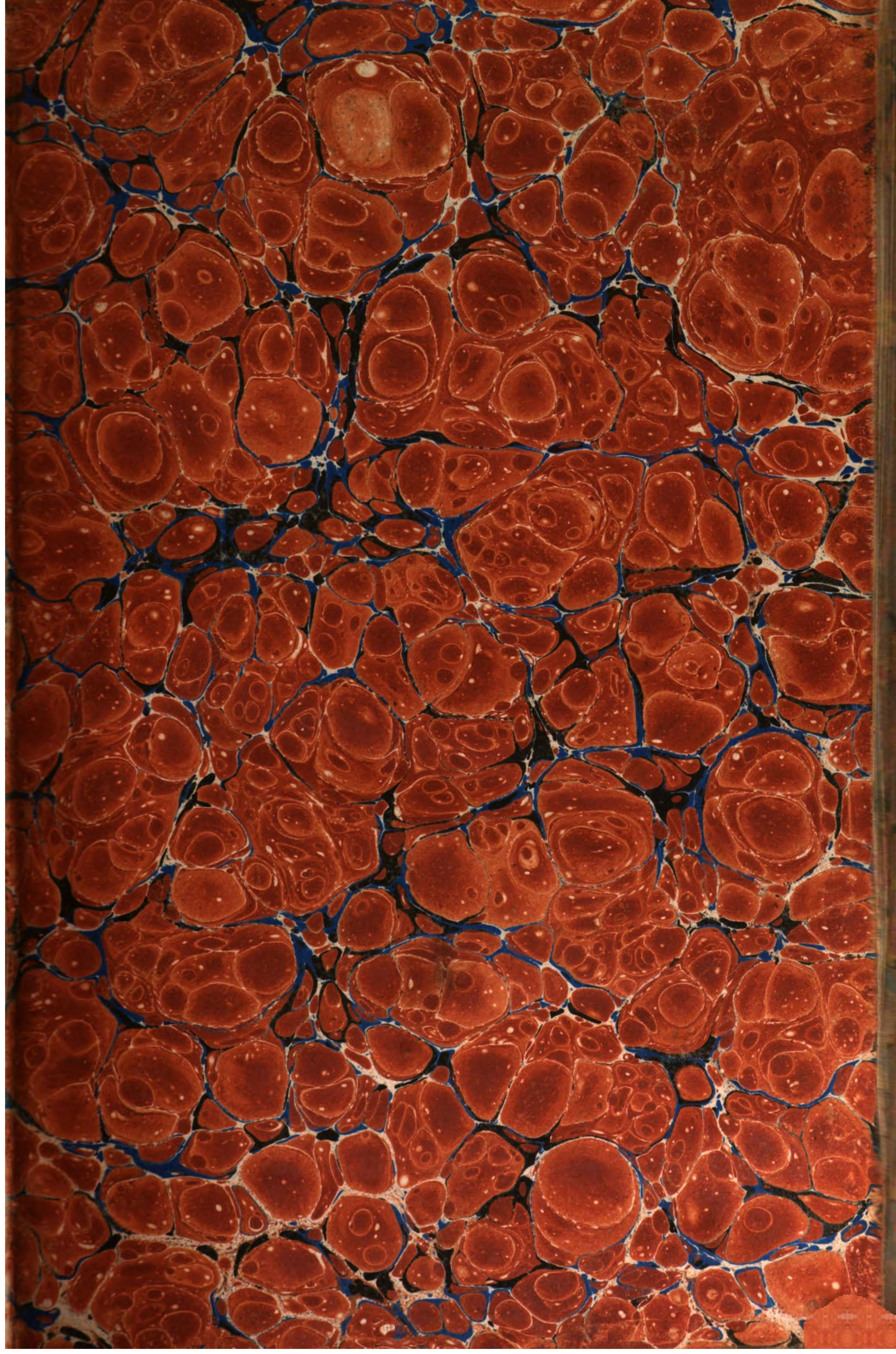




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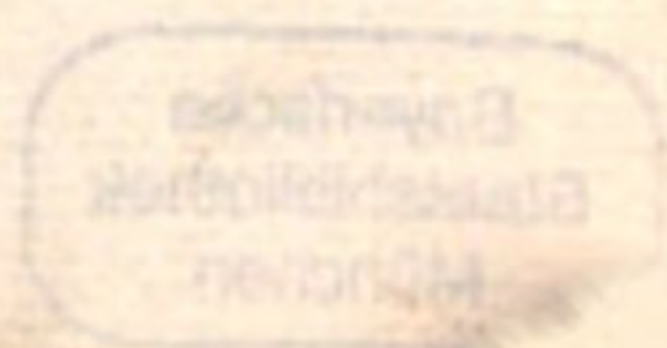
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VOL. 37.

Arts connected with Trade

1836.



SELECTION

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OF THE

HOUSE OF COMMONS

Vol. 37.

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R E P O R T

FROM THE

SELECT COMMITTEE

ON

THE LAW RELATIVE

TO

PATENTS FOR INVENTIONS.

Ordered, by The House of Commons, to be Printed,

12 June 1829.

R E P O R T

R E F E R E N C E

FROM THE

SELECT COMMITTEE

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TO

PATENTS FOR INVENTIONS.

Ordered, by The House of Commons, to be Printed.

12 June 1850.

MINUTES OF EVIDENCE

R E P O R T

R E P O R T.

THE SELECT COMMITTEE appointed to inquire into the present state of the Law and practice relative to the granting of **PATENTS** for **INVENTIONS**; and to report their Observations thereupon to The House; together with the **MINUTES** of **THE EVIDENCE** taken before them:—**HAVE** agreed to the following **REPORT**:

THE subject referred to the consideration of Your Committee, is in its nature so intricate and important, that it has occasioned the necessity of examining Witnesses at great length; at the present late period of the Session, they are only prepared to report the **MINUTES** of the **EVIDENCE** taken before them, together with several Documents; and they earnestly recommend to The House that the inquiry may be resumed early in the next Session.

12 June 1829.

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MINUTES OF EVIDENCE.

Veneris, 8^o die Maii, 1829.

THOMAS BARRETT LENNARD, ESQUIRE,

IN THE CHAIR.

Mr. *John Taylor*, called in; and Examined.

ARE you conversant with the taking out of Letters Patent for Inventions?—
I have had some experience formerly, but not much of late; my time was then chiefly employed in manufactories, which led me to interfere with patents.

Mr.
John Taylor.

What is your opinion as to the policy of the laws relating to the granting Letters Patent, as a mode of rewarding inventors?—As to the policy of rewarding inventors, it seems to me just and right that some reward should attach to inventors; and there can hardly be such a reward without some monopoly, at least as far as my judgment goes.

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Describe to the Committee the mode of taking out a Patent?—As soon as an invention is to be exercised in this way, it becomes necessary, in order to secure it, to keep it perfectly secret for some time; the law, I believe being, that any publication before sealing a patent would vitiate that patent; this seems to me to be the practice, and is one of the general objections to the present law; because as the invention, be it what it may, necessarily involves experiments of some sort, and as those experiments can hardly be conducted perfectly in private, or without the assistance of workmen and others, a revealing of the secret may thus take place which is fatal to the patent afterwards, if confidence is broken.

Have you taken out patents yourself?—Yes; I took out a patent for oil gas, and have been concerned in others.

What is the first step taken by a person who desires to obtain a patent?—The first application, I think, is for a caveat, which entitles the party taking out the patent to notice from the Patent Office, in case any one applies for a patent for a similar invention.

Of something supposed to be similar?—Yes, or something supposed to be similar.

Is that a mode usually resorted to?—Yes, that is the common mode resorted to, I believe; the intention seeming to be, to give support to inventions against incroachments which might be made upon them, which might not be fair.

Upon a person's receiving notice that a patent is applied for for a similar invention, what takes place?—A hearing is appointed before the Attorney General, and each party states explicitly to him the nature of his invention; and the Attorney General then decides whether the patent is to be stopped by the previous invention or not.

Do the contesting parties make their statements in the presence of one another?—Certainly not; the statement on both sides is to the Attorney General only; no other party being present.

State, as far as your experience goes, whether it frequently or very seldom happens that an opposition has any effect?—Very seldom, that I have known; I was opposed upon some patent I took out; and I had to make a statement to the Attorney General, who decided it instantly.

I think the Attorney General considers that every applicant who takes out a patent, is to be at the risk of any opposition which is made to it?—Yes; it is at his own risk entirely.

What is the expense of entering a caveat and of resisting a patent?—The entering a caveat is a very small expense; I think a guinea or two; and it may be continued for a small annual sum—do you mean the expense of obtaining a whole patent?

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John Taylor.

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No; the whole expense arising from opposing a person applying for a patent?—I do not know exactly, I do not recollect that part of the business; there are other gentlemen who can tell you more about the charges than I can; but it depends a good deal upon the expense which the parties are put to in making the models or preparing plans; I believe, it is not very expensive; but it sometimes happens, in order to make the subject intelligible to the Attorney General, that a good deal of expense must be gone into.

Is it not sometimes necessary, that very expensive models should be prepared?—Yes; in some cases it is.

That of course is attended with very great expense?—Yes; but taking out the caveat is not attended with much cost.

Are persons obliged, when they take out a patent, to enter a caveat?—They pay for a caveat in order to entitle them to notice of any new patent which they think might interfere with their patent, and for which they are therefore obliged to become opposing parties; and further, in order to know every patent that passes through the office, by paying a certain annual fee of a guinea or two, which I believe is the charge of the caveat, they become entitled to constant notice of patents which are applied for; of course they are informed of such as are likely to interfere with their patents.

—Are you aware that caveats are sometimes entered, stating the invention claimed, in very general and indefinite terms, with the sole object of enabling the parties who have entered them, to oppose parties applying for patents, and thereby compelling them to make a compromise with them?—I have heard that this is done, and that persons have taken caveats out upon some concealed principle; and when any patent is applied for, which they have thought might be opposed by such caveats, they have called upon the parties, and a treaty is entered into, and it sometimes follows, that a sum of money has been agreed upon to be given that the opposition should be withdrawn.

Do you think that practice exists now?—I have never experienced it myself, but I have heard of it.

When a patent is granted, I believe it is upon condition that the thing applied for shall be described?—Certainly it is.

Do you conceive that practically there is much difficulty in making a specification?—Yes, great difficulty while so little opportunity is afforded to the inventor for experiments to devise the best means of carrying his invention into effect; he is obliged to make his experiments without the assistance of others, and without such assistance it is impossible for him to have the power of making all those trials which would give him the best opportunity of describing faithfully to the public his invention, and any error he may make in his specification, however unintentional, would afterwards completely vitiate his patent; it appears to me one of the greatest difficulties of the present law.

What is the time usually granted?—The usual time is two months I believe; but sometimes it is extended by the Attorney General on particular reason being shown, such as that it is more than commonly difficult to describe the invention in the time usually allowed; I know one instance where there was a patent in which one of my brothers was concerned, it was a printing machine originally invented by an ingenious foreigner, it required an immense deal of thought and labour, and involved much mathematical calculation; I believe twelvemonths was allowed for that specification.

But in the present state of the law, would it not be inconvenient to give a longer time for the specification?—It would, certainly, as other parties might be injured by it.

Might it not, in point of fact, enable a party to avail himself for some time of the benefit of the patent, and after all not give the public the benefit of it?—It might also defeat other inventors in their plans.

Does any remedy occur to you to prevent inconveniences of that sort; are you aware of any other course which could be pursued?—I confess I have not considered the subject well enough to be able to give an opinion upon it.

Do you know what the law of France is in that respect?—In some points I do know the law of France, but I am not very conversant with it; I apprehend they adopt a totally different principle in France. I believe there patents are referred to a commission, composed in some degree of scientific men.

Is a commission appointed in each case?—I believe so; in England the principle is, that the risk of the patent is upon the patentee, who must defend it at great

great expense. The principle in France, is, I think, to settle first whether the patent is to be granted by referring it to scientific men, and if they determine that it is a fair subject for a patent, the law then protects it, and there is no risk to the patentee afterwards.

Do you think that a scheme of that sort could be adopted in this country?—I doubt whether a commission of that kind would be according to the common principle of the English law; but I do not pretend to have thought much upon the subject.

Do you not think a commission, composed partly of lawyers and partly of scientific men, might be appointed, for the purpose of examining a specification, in order to ascertain whether the machinery might be made according to the description given?—I think it would be liable to many objections; at the same time there might be some advantages in it, but I doubt whether the objections would not over-rule them.

What are the objections which occur to you?—Perhaps the difficulty in the first place, would be in selecting scientific men, and there might be a good deal of jealousy as to their decisions; I think the great objection would be, the difficulty of appointing such a commission as would satisfy the public and the inventors.

But if that difficulty was obviated, would any advantage arise from the appointment of a commission for such a purpose?—Then I could conceive such a plan might be very advantageous, as it would determine the thing at once.

So that the patent might not be impeached upon the ground that the specification had not accurately described the thing?—Certainly on that ground, and probably also on others, such as whether the invention was new or not, which might be decided in the same manner.

Do you conceive it possible there would be any difficulty in finding persons to form a commission fully competent to decide on these points?—I think men might be found to form a commission of that sort; but perhaps a court of justice would, after all, be more satisfactory to the parties.

Are you aware that persons frequently specify incorrectly, for the purpose of misleading the public, and concealing from them their invention?—No case of that kind has come within my own knowledge, but I have heard it is so; but a specification very often is found to be incorrect, more from the cause I have before stated, than from intention to mis-state it.

Are you acquainted with Arkwright's case?—No, I am not particularly.

You say you have heard that. Supposing it to be true that persons sometimes specify incorrectly with a view of concealing their invention from the public, would not a commission, such as I have described, confer as much benefit on the public by guarding it against incorrect specifications, as on the public?—I think it would. I remember where a most important improvement on the manufacture of oil of vitriol was the object of a patent by Mr. Hills, which was litigated for a long time; it was a case in which I happened to be a witness; and the specification was attacked upon the ground of its being inadequate; the patentee however succeeded in defending it; it was evident he might have made a better specification if he had had proper time to have carried his invention as far as he afterwards did; and a doubt arose, whether by making the invention afterwards more perfect, he had in that way departed from the specification to a certain extent, and thus had vitiated the patent. The court certainly held he had not done so, and refused to set the patent aside; but it was much contested, and the patentee very nearly lost a great deal of money and labour which he had bestowed upon the process.

It is one of the rules of law, that the title of the patent must very accurately correspond with the description given in the specification?—It must certainly include every thing.

Is not the first idea of an invention often very imperfect?—Certainly.

Does it not often happen that the inventor makes great alterations and improvements in his invention, between the time of his making application for his patent, and that of enrolling his specification?—Yes.

Supposing, between the time of his taking out his patent and the period for enrolling his specification, he should discover very considerable improvements in his invention, what course is he obliged to take?—The title must include the whole invention; as the law now stands, every inventor tries to frame a title that will include every thing relative to his invention, and may, in fact, make it rather a delusive title; for instance, a person taking out a patent for oil gas, may call it a patent for a better mode of lighting, or something else taking in the whole; or an

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improvement in steam engines may have been put under the title of certain improvements in machinery; and so, by using very general words, taking the most ample form, so that the invention may be clearly comprehended without pointing out particulars.

Would there be any danger, in such case, of the patent being void for uncertainty?—Not if the title includes the invention truly; it is common for titles to be of that description. I have stated an exaggerated case to explain the thing, but that is the principle upon which every one goes; and there is another reason for what I have stated, the patentee wishes to avoid discovering to other inventors for what he is about taking out a patent, and gives it a title which may mislead.

But it may often happen they cannot precisely describe their invention?—Yes, certainly.

And that causes great difficulty, if his title will not include his invention?—Of course, then, his patent would be good for nothing.

Would he be obliged to take out a fresh patent?—Yes, he would be obliged to take out a fresh one.

Have they any means of avoiding that in France?—I am not sufficiently acquainted with the detail of the French law of Patents, to give that information, but I believe it goes before the commissioners; I do not know whether their law of title is the same as ours exactly.

If a man, in his specification, includes a thing as new which has been previously discovered, the patent for the whole invention is void?—Yes, the whole patent.

Do not you think it would be a benefit to the public, if a plan was adopted by which a man should be allowed to retain a patent for that part which is new, making it void only for what is old?—Certainly; it has appeared always to me a great hardship and injustice, that a man should be deprived of the whole patent.

According to the present law, an inventor who *bona fide* intends to give ever so true a description of his patent, may yet give so imperfect a description, that he may lose his patent?—Certainly he may, most unintentionally.

Would not a commission, authorized to consider and determine upon the sufficiency of a specification, be a means of guarding against this evil?—If it was possible so to alter the law, that that publicity which experiments may require, should not vitiate the patent, it might be beneficial; for instance, after giving notice, or taking out of a caveat, that then the inventor should have a certain time allowed for making experiments, and that such experiments being known to people to whom he will be obliged to reveal his secret (workmen for instance,) should not afterwards vitiate the patent; and I should think that this would be a step to improvement, at any rate.

Between applying for the patent and sealing the patent, if there is any publication, that will vitiate the patent?—Yes. The law considers the publisher as the inventor, therefore if I invent a thing, and I set about experiments, and call in any one to my assistance (and it is obvious, without the aid of workmen but little could in general be done,) any one knowing my patent, and becoming the publisher, that man publishing it in England in any way, would vitiate my patent afterwards, because, by the law, the publisher is deemed to be the inventor.

If a man enters a caveat, and his invention afterwards becomes published through the means you have stated, will he not be allowed to go to the Attorney General and say he is the first inventor?—That will not assist him in deciding his right to the patent if there is any publication afterwards. I apprehend from the time of his taking the first step to get a patent to the time of sealing the patent, which is the last step, any publication would vitiate the patent if proved subsequently at any period in the whole fourteen years.

Does not that lead frequently to breaches of confidence?—It is apt to do certainly, but inventors generally apply to patent agents who are aware of that, and they caution them to trust their secret to no persons but those in whom they have entire confidence.

Are there not many inventions which require the assistance of a number of persons to carry the experiments into effect; an invention of machinery for instance?—Undoubtedly.

In that case then, a man is very unwilling to trust any body till the patent is sealed?—Certainly, and generally speaking they do not.

Does it then often happen that a person is obliged to make out a title for a patent before he knows exactly how to describe the invention?—I can relate what I did in my own case, where a mode having occurred to me of making gas from oil, &c. I proceeded

proceeded to try a slight experiment assisted by my workmen, and to prevent their knowing what I was about, after I had made the experiment I instantly destroyed the apparatus. I mentioned it afterwards to my brother, and then waited patiently till the patent was sealed; of course I could have made a much better specification if I had been allowed to have gone more fully into experiments before the time which is allowed had expired.

You have said any publication of the invention before the patent is sealed, vitiates it?—So I have heard; and if there be a breach of confidence, and the person to whom the invention is entrusted first becomes the publisher, he defeats the inventor's patent; he cannot take out a patent himself because the other is the original inventor, and he has in a mode published it by the caveat; both lose it, the latter cannot step into the inventor's place.

Are there any means by which an inventor can guard himself against such a breach of confidence; for instance, by making those to whom he entrusts his secret enter into a bond not to divulge it?—I believe that is frequently done. I know a case very lately where a person intended to take out a patent; I do not know whether he has done so or not; I believe he is too poor to do it; he revealed the secret to two or three persons under a bond under a large penalty; he shewed it to me without any such proposition. I did not want to see it, but he did it in perfect confidence.

Workmen employed to perfect an invention are usually persons without property; how then would a bond from such persons be of any value or use to the inventor?—In such a case they would be of no use, and perhaps they would not be induced to give it.

Those persons however may equally commit a breach of confidence?—Clearly so; indeed it was lately in evidence in the last case which was tried of Mr. Crossley's, where it was in evidence that another person gave evidence against the patent who was a workman and had access to drawings and plans which he used for the purpose of his experiments, and thus tried to vitiate the patent.

Since it is a principle of law that the publisher is considered as the inventor, how does it happen that if a person concerned in the experiments upon any new invention divulges that invention, he is not entitled to a patent?—The other published before him to a certain extent; the first inventor would then show that he could bring proof he invented it, and had used it to a certain extent; and thus he could not claim the patent.

What is the sort of publication of an invention, which would vitiate a patent?—I believe a communication to any third person who would prove it, has been held sufficient publication; or if it has appeared in print in any way in any book circulated in England.

Do you conceive a communication of the invention to workmen, who are employed by any person to make experiments after a caveat and specification had been given, would be a publication?—I believe the courts have differed as to that point at different periods; I think a few years ago it was held that any thing in the shape of publication vitiated the patent; but I believe the construction of late years has been a little more favourable to inventors; of course I can hardly know what the real rule is; but I believe the practice of the courts formerly has rather differed from what it is at present; I own I have not had much experience on that subject; but I have understood the courts lately have discountenanced applications against patents on the ground of publication by confidential people, rather than to have decided in favour of such applications, and as far as they could have set their faces against it; but I rather think it is the practice of the different Judges than the state of the law.

Would the use of an invention not communicated to the public, preclude another person who may also discover the same invention from obtaining a patent for it?—No; such person certainly would not be prevented, if it was not published, but kept perfectly secret.

Could he, by applying for a patent, prevent other persons from going on with that invention?—I do not know; I have not much experience of such patents; but I should think if he felt it necessary, he could enforce his patent against others, but not against a former inventor.

You think the patent in that case would stand good?—Yes, I think it would, because the second inventor is the publisher; and therefore the inventor according to law, the other never having communicated it to the public; but I think the first inventor, upon proof that he had used it, could not be prevented going on to the same extent as he had formerly done; that is what I understand to be the law.

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What do you mean by the words "to the same extent"?—That having carried on a secret process in his manufactory, and never having revealed the discovery of the same thing as the patent, I think the patentee could not stop the manufacturer, if he could prove he had worked it before the patent was granted.

Could the original person who invented it, stop the patent of the second?—No; he had never given it to the public, and that is what the public require by a patent.

Could he not stop the patent of the second person?—If he chose to publish it before the second person's patent was sealed, he could prevent its going forward to the world as that person's invention.

Do you not think such a case as that exists, as a person discovering an improvement in machinery, and keeping it private?—I think it would be difficult to keep secret any invention in machinery, as so many persons must necessarily be employed; a chemical invention might be kept secret, but I do not think a mechanical one could.

Do not such cases constantly occur, which leads to negotiation between conflicting inventors?—Constantly; I think a patent may involve parts of principles which are found, when it comes to be used, capable of considerable improvement by the adoption of things claimed by others; the common practice then is to negotiate. The Attorney General sometimes, I believe, recommends it.

There is a compromise?—Yes, by giving the first party an interest in the patent.

What is your opinion with respect to the policy of leaving specifications open to the public; do you conceive it desirable in any case, to give a commission power to conceal the specification if necessary, so that the invention might be made more complete?—I think it would be of great advantage to the inventor, but I doubt whether it would not be giving to a party applying to take out a patent, too much protection against any improvement which might be made by others; it is a thing I can hardly judge of; of course it should only be concealed for a time.

Only for a time, not for the whole period?—That would involve a question of the duration of the patent altogether.

Have you any suggestion to make upon the period for which patents are granted?—Merely that there is a difficulty in the term of fourteen years; it does not seem equally fair for all patents; one patent might deserve protection for three or four years, another for twenty years, and so on, according to the utility and expense of them.

Then to whom would you leave the responsibility of giving a proper duration to patents?—That would be one of the great difficulties of the commission. It is the practice I believe in France, to give patents for different periods.

Is not that left to the discretion of the person who takes out the patent, in some degree?—I believe it is; but I do not know exactly what the practice is.

Is there not a time fixed in France, beyond which patents cannot be prolonged?—I believe so.

Inventors there, may take out patents for shorter periods if they please?—Yes, they may.

Will you suggest any thing which occurs to you, as likely to be beneficial in altering the present law as to that?—For the same reason which I have given in my reply to a former question, I think there should be a difference between the time patents should run which are taken out for trifling inventions, and more important ones, or which involve great expense.

Is there but one period for all patents?—Only one period, fourteen years; but they have been sometimes enlarged beyond that period by Parliament.

Are you acquainted with the law of France upon patents?—Not very well.

Patents there are taken out for shorter periods, are they not?—Yes.

Are you aware that they are taken out at a smaller expense?—Yes.

In France a man may take out a patent for five years, may he not, at a third of the expense to what he can here?—Yes, he can take a patent out at a very small expense; it is I believe common to take out patents for four or five years.

Do you think such an alteration, in the law of this country, would be beneficial?—I think it would.

Are there not inventions where the inventors can only calculate on the invention remaining in vogue for a very short time, the kaleidoscope for instance?—Yes, certainly; they never can calculate upon any profit except on the first sale, because it would be idle to bring actions for every interruption of such patents.

Would

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Would it not be just then, in such case, that the inventor should be allowed to apply for a patent, for such a period short of fourteen years as he pleases, paying a proportionate fee?—I should think that would be advantageous.

Would it also be desirable, that a man taking out a patent for five years, at a third of the cost of a patent for fifteen years, should be allowed to add any improvement which might occur to him subsequently to his original patent, and take the whole out for the term of fourteen years at the expense of one patent?—I think that would be somewhat consonant to the French law.

That he might take out a fresh patent for the improvement, if he chose, at the expense of one patent?—That might be beneficial, but it ought to be a clear improvement upon the first invention.

It might happen that a man would be very glad to have a patent for his improvement for a less period?—Certainly.

Do you know whether the low rate of fees in France, leads to many frivolous applications for patents?—I have not had experience enough to know that, but I apprehend there is a check to that by the commission, that it does not operate so there; the patent must be passed, I believe by a certain commission, which is composed of scientific men.

Are you aware that in France, if a person who has obtained a patent, during the period he holds that patent, makes any improvement on it, he is obliged to give in a description of the improvement, in order to its being made known to the public?—I am not aware of that fact.

That is not the practice in this country?—No.

But would it not be useful that there should be some regulation of that sort?—I think some regulation of that sort would be very beneficial; I think many improvements are withheld from being published on account of the difficulty and expense of taking out a new patent.

Do you think it a fair thing to require from the patentee, that he should communicate to the public any improvement he may make during the period of his patent?—I think it is extremely fair, and that the public should have a right to require it.

Is it the practice in France, if a man takes out a patent, and neglects to carry his invention into effect within the period of a few years, that he loses his patent?—I do not know that.

Do you think in this country, it would be desirable that the patentee should be required to carry his invention into effect, or lose his patent within a limited period?—I should think it would; I think there is a provision to that effect, but I am not quite sure; I think the patent is good for nothing without it be carried into effect within a certain time.

Suppose a man taking out a patent for an invention, has not used his invention for five years, should not his patent be void at the end of five years?—He cannot be obliged to give up his invention; but certainly his patent ought to lapse unless it is produced in a given time.

At present there is no definite time?—No, I think not.

It would be desirable to fix the time then?—Yes.

Do you conceive there would be a substantial benefit to the public by publishing a description of the patents taken out, in the Gazette, a catalogue of them?—I apprehend that they are well published at present; it is a matter individuals are glad to publish if the patents are worth any thing. I think they are most extensively published in periodical works which are devoted to the purpose, and I believe they find a sufficient sale and are more within the reach of those who want this kind of information than the Gazette itself would be.

It is a rule of law for patents not to be granted on abstract principles, is it not?—Yes, I understand so.

Do you conceive any inconvenience arises from that rule?—Yes, I think it is inconvenient. A person may not immediately have a technical mode of applying such principles; a principle may be applied in half a dozen different ways. I think it is very hard that from an imperfect plan a good principle should be lost.

At present persons taking out patents are desirous to include not only the principle of the method of invention they describe, but any other method that may arise from that principle?—Yes.

Do you conceive that is legal?—It has been so much discussed in courts of law that I can hardly be a competent judge of it; in some cases they seem to have determined one way and in others another.

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Does not the prohibition to inventors to claim a patent on abstract principles, lead to an unnecessary multiplication of details in the specification?—Certainly, it leads to the use of words trying to embrace all sorts of things, which embarrasses the specification very much.

And is not the public, from the multiplication of details, really left in the dark as to what is the nature of the invention for which a patent is so claimed?—Very much so indeed.

Are not there many instances in which the only way of ascertaining whether a principle is discovered, would be by reducing it to practice?—There are some instances; but I think a principle may be sometimes clearly stated as applicable where an inventor has not at any rate practised it in the best way. In a case lately agitated of Mr. Crossley's, it was a method of measuring gas; it was a very ingenious one indeed; I think the patent was established; the principle was well detailed, but the particulars of the application were exceedingly difficult for persons not scientific to understand; it occupied the court a great deal of time, but the principle of the patent was quite clear to all scientific men.

Does it not often happen that these details are only introduced for the purpose of bewildering the reader, and not letting him know what the invention really is?—That has been so in some cases.

I think one of the rules is that there shall only be five persons named in a patent in this country?—Yes.

Is that an inconvenient one?—I think it is in many cases, because with only five persons, an inventor may not be able to raise a capital sufficient to carry his intention into effect, which might be done if a greater number of partners could be introduced to a share in the invention.

Does not that interfere with the rule?—I believe the rule is sometimes avoided by putting in names under licenses or as trustees for others.

Are you aware of the ground upon which the rule is adopted of limiting the number?—No, I am not.

Are you acquainted with the expense of taking out a patent?—I think a patent for England, Scotland and Ireland, if not opposed before the Attorney General, and there is not much difficulty in it, will cost 450*l.* or 500*l.*

Is it the same expense, if a patent is taken out for the colonies?—Then I believe it may be more expensive; it would not be more than 500*l.*

Is the expense without reference to the nature of the invention?—Yes.

When a man wishes to take out a patent for Scotland or Ireland, or any other place, is greater time given to him to make out his specification than in England?—I am not aware of that; I believe there is.

You stated the usual time for putting in the specification to be two months?—Yes, two months.

Supposing a person wishes to take out a patent for Ireland, how soon would he be obliged to give in his specification for his patent; is longer time allowed than in England?—I do not exactly recollect the detail as to that.

But if there should be considerable delay in getting a patent in Ireland, it might happen that he would be obliged to specify in England before his patent, which had been taken out, could be received?—He would lose the patent then.

In that case, the object of an inventor might be frustrated in Ireland?—Yes.

Are you aware that has happened in any case?—No, I am not.

Would it not then be a great convenience, that a person should be able to take out a patent at once for the whole of the United Kingdom?—Certainly.

Is the person before whom the different patents are taken out in the three kingdoms, the same, or do different persons grant them?—They are all taken out by the same agents, I believe.

Are the expenses nearly the same in Scotland and Ireland?—I think not; I do not recollect the proportion, but I believe the expense is considerably higher in one than the other.

Must you prove your case before the same person, if there should be any opposition, in one country as well as the other?—It is the Attorney General by whom the patents are granted; I do not recollect exactly the process, but I believe the inventor generally has little more to do than to pay the fees, and give the specification in.

Do you know what is the policy of allowing a person to take out a patent for an invention communicated by a foreigner and excluding him from taking out a patent for an invention communicated by a British subject?—No, only that it seems to depend

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depend upon the fact of publication; one becomes a publication in England if it is a communication by an Englishman, it may then be supposed an Englishman knew it before; I know no other principle upon which it goes but that.

What is the policy of such a law?—There seems to be no policy in it at all.

Is it not often the case, when an Englishman wishes to sell an invention of his own to another person willing to take out a patent, that he first communicates it to a foreigner, who afterwards communicates it to the person wishing to become the patentee?—I think that is very likely to be the way, but I do not know any case of the sort myself.

If you were an inventor and could legally communicate it to a foreigner, and thus enable another person to become the patentee, is not that the course you would have recourse to if you wished to sell a patent?—I cannot say without recollecting the form of the oath.

If you could legally do so?—Certainly, if I did not violate good faith in doing it.

Do you not think it expedient that persons should be allowed to take out a patent, for a secret communicated to a person by another person, being a British subject?—Most clearly so; it may happen that a poor inventor may put into the hands of a richer man a good invention, which the richer man may take out a patent for, and work to the advantage of the public; but as the law now is, the person applying for a patent must swear he is the inventor, before he can take it out.

In that case patentees may very often perjure themselves?—I have not the least doubt of it.

Then you think the oath at present taken, is impolitic and unnecessary?—Yes, I do.

Does any inconvenience occur to you as being likely to arise from a person taking out a patent for an invention communicated by another?—None; the principle of the law as now applied is, that the publisher is the inventor, which seems contradictory to the spirit of the thing; I think also, that the mere invention is often of much less value to the public, than the bringing the invention into actual practice.

If secret patents were permitted, might not great hardship be inflicted upon other persons who might be expending their money in bringing to perfection some invention, for which it may afterwards be found a patent has been granted, that they should be excluded from practising that invention?—I think so, certainly.

The question presumes that the inventor is secretly perfecting his invention, without having knowledge of that invention for which a secret patent has been granted?—It would be injurious.

I think you have stated that titles of patents are generally so vague, as not to inform the public what the nature of the invention for which the patent is taken out really is?—Generally so, I believe.

The object of making a title so vague is, to prevent the attention of the public from being drawn to the particular invention until the patent is sealed?—Certainly.

This inconvenience arises out of the law which vitiates a patent between the period of entering a caveat and the sealing of it, if any publication takes place?—Yes.

Have you any observations to make upon this subject beyond what you have stated?—Nothing has occurred to me, except the expense, which is one of the great objections to taking out a patent, and the great difficulty of maintaining it.

Is it not a fact that owing to the uncertain protection afforded by a patent, many inventors are deterred from resorting to it?—Many are so.

Are you of opinion the expense is so large, as to operate as an inconvenient check to the object of the patentee?—I think it is very often so, in the case of inventions of slight things which might be useful to the public; the expense is disproportionate to that of larger patents; the great evil is having to defend your patent in a court of law, if there is any infringement.

Supposing patents were made for different periods at different prices, do you conceive if certain prices were to be fixed on patents and a period of fourteen years allowed for an important patent, would that be too large a period, or do you not think that it is necessary the expense should be to a certain amount in order to check frivolous applications?—The expense ought in a great measure to depend upon the nature of the patent.

Do you not conceive the present expense is necessary in order to check frivolous applications?—I do not think it necessary nor does it seem to check it. I do not think the expense is so objectionable as the uncertainty of the law.

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When an infringement of a patent takes place, what is the mode pursued by the patentee of preventing that infringement continuing; is it by an application to the Court of Chancery for an injunction?—Yes, in the first place, but the injunction is always dissolved upon the application of the other party to try it, and the defence of a patent is one of the most expensive kinds of defences on account of the kind of witnesses that are generally necessary; it has become the fashion of late to subpoena a number of eminent scientific men, some perhaps brought from a great distance. The expense of defending a patent has now become enormously great.

Do you see any reason to doubt that it is good policy to allow any person who applies, to question the validity of a patent?—I think every one should be allowed to question a patent if he sees there is reason to doubt of its validity; this however of course leads at once to litigation.

What other mode is there of trying the validity of a patent, except by allowing a person who applies to infringe it?—I think it is good policy to allow any body to attack a patent if the means of defence were not so uncommonly burdensome. I think it ought to be open to attack.

Have you any suggestion to offer for the purpose of reducing the expense?—I could hardly venture to suggest any; my attention has been so little directed to the subject, and I cannot exactly say what it should be; something might be devised if a commission was appointed which might avoid what is now very burdensome, the mode of trial to protect a patent; it is now absolutely necessary to call a great number of witnesses to prove a patent at a great expense.

There is no mode of defending your patent except by constant vigilance?—No.

Patentees do not bring actions against every person who infringe their patents?—No, they could not.

Can you devise any other mode of defending a patent except by witnesses before a jury?—Unless it can be brought to some other mode of contesting it at a less expense.

Questions on patents are sometimes tried by special juries; do you know whether any inconvenience arises from that sort of tribunal?—It is difficult to get counsel to explain a case properly to the jury, and to get their attention excited to such inquiry; it is very difficult to explain, even to gentlemen who have more attended to this kind of subject, and requires most expensive models to be made; it is very often exceedingly difficult to make even the Judge understand.

Do you not think it would be better if a commission could be formed of scientific men, who are accustomed to the thing; that it would be a much cheaper and much better mode?—I think it would be a better mode, as it would avoid all that immense train of scientific witnesses, often conflicting with each other, which adds so much to the expense.

Do you think that a tribunal of scientific persons would be a purer tribunal than that composed of persons indiscriminately chosen?—I do not think it would be a purer tribunal, but I think it would be as good a tribunal, and might be much cheaper.

Do you not think it would be much purer, and more competent?—I think it would be as pure.

Supposing a commission was deemed advisable to be formed of scientific persons, do you imagine confidence could be placed in such a tribunal, for the purpose of deciding disputes of patents?—I dare say there would be jealousy; I think that would be one of the inconveniences of it; I do not mean to say a commission would be quite satisfactory.

Can you state any other mode which would be more advisable?—No, I cannot.

Do you think there would be more inconvenience from the jealousy it might occasion, than from the present incompetent sort of tribunal?—I think not; avoiding the expense would be a great thing; upon the whole, balancing the evil, a commission might be the better thing.

If a commission was appointed, must there be a commission for each case separately?—I should think there must; a commission might be something in the way of arbitration.

Do you think, if such a commission was established, people would object to a small addition being made to the expense of a patent, taking the benefit of the commission, which would be kept I apprehend at a small expense?—I should think not, if the patentee could avoid the chance of litigation.

You think not, if he avoided the expensive mode of proceeding to a court?—No, the expense of a court is frequently most enormous.

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Do you not imagine in consequence of the expense and difficulty of defending patents, that there are successful attempts at infringement in many cases?—I should think so; the case of the Kaleidoscope for instance, it would have been quite impossible to have defended that patent; they must have brought five hundred actions.

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Are you acquainted with any case where a person's patent has been infringed, who has abstained from defending his patent?—I do not recollect hearing of any, but I have no doubt that is very often the case.

Would not one objection to a standing commission be, that it would require such varied knowledge as you can hardly expect to meet with in a limited number of individuals?—I think it would; if there was any commission, the structure of it should be arbitration, rather than a standing commission.

Davies Gilbert, Esq. a Member of the Committee; Examined.

WHAT is your opinion of the policy of the present law, in granting patents upon abstract principles?—The object of the present law of patents is to excite ingenuity; there must be encouragement held out to persons by the community, to exert their talents for the benefit of the public.

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Esq. M. P.*

What is your opinion in respect to principles being the object of patents?—I conceive that the invention of a principle is a much greater achievement, and much more likely to produce great public benefits than the invention of any mode of applying a principle already known; I therefore think that *à fortiori*, there should be protection given, and encouragement held out to the discoverors of new principles, and that they should be secured to their inventors for the legal number of years, but always assuming that some practical mode of applying them to useful purposes make a part of his invention, and is included in the specification, and then I think that the inventor should not lose the benefit of his temporary monopoly in consequence of another or even a better mode of application being discovered.

What is your opinion of the expediency of appointing a commission, composed of scientific men and lawyers, to examine a specification before it is enrolled, to ensure the patentee from having his patent afterwards impugned?—I think it would be highly expedient that some person or persons more competent to judge of scientific matters and inventions than the Attorney General, from the course of his ordinary pursuits, are in general to be found, should be called to his assistance; but I would not preclude either party from any subsequent legal remedy he may choose to adopt.

Do you not consider it might be beneficial that a commission should be appointed to examine a specification before it is enrolled, in order to see whether the discovery is sufficiently described or not?—I have stated that it would be highly expedient to assist the Attorney General in such cases, and especially when any points are disputed; but I would not have the determination in such cases preclude persons from proceeding to a court of law.

You would not have a commission then to inquire whether the specification really agreed with the invention or not?—So far as it went to guide the opinion of the Attorney General as to granting patents at all, and to whom they should be granted, I think a commission would be highly useful; but I entirely dissent from any opinion which would give authority to such decisions, so as to preclude persons from recovering afterwards in a court of law.

Do you not think it desirable that a commission in some cases, should be appointed?—Yes.

Would it not be desirable that the evidence taken before the commissioners should be perpetuated so as to be produced in a court of law, in any case where the patent should be impugned, in order to enable the patentee to defend his invention?—I should not have the least objection, if it were practicable.

What is your opinion of the policy of the law which vitiates a patent, if one feature of the invention, described in the specification, is proved to have been known before the sealing of the patent?—I think that the rule of law which vitiates the whole of a patent in consequence of a partial defect, is inexpedient, unless fraud can be proved.

If it should be found convenient to make an alteration in the present law, do you think that a tribunal of scientific men would better decide the validity of a patent, than if it was tried in a court of justice?—It must frequently happen in a court of law, that neither the counsel nor the jury are qualified, by their previous knowledge,

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to decide on such cases, and consequently, men of general science, acquainted with the subjects in dispute, must be more competent to forming accurate judgments in respect to them; but I am not aware how a tribunal of such persons could be formed, unless it was done through the medium of a reference. The definition of a man of science, would seem to be a matter of no small difficulty.

Do you think it would be convenient to have a commission of scientific men, and not a jury?—With respect to a commission of scientific men, I certainly think they would be more competent to decide, but public opinion would probably not be so confident of their exemption from bias from *esprit de corps*, perhaps from influence, as in the case of our ordinary tribunals.

What is your opinion of the policy of allowing a person to take out a patent for an invention communicated to him by a foreigner, and excluding him from taking out a patent for an invention communicated by a British subject?—I am of opinion that it should be lawful for a person to take out a patent for an invention communicated to him by a British subject, provided, of course, that it appeared the communication was voluntary.

Will you state your opinion as to the propriety of allowing persons to take out a patent for a shorter period, paying a proportionate smaller fee?—I should think the fees of patents cannot be made proportionate to the importance of the invention, and consequently it may be advantageous to allow individuals judging for themselves, to secure a monopoly of less than fourteen years, on paying diminished fees.

Might it not be advisable to make different regulations for the different sorts of inventions, separating, for instance, the mechanical from the chemical discoveries?—I think it would.

Lunæ, 11^o die Maii, 1829.

Mr. John Farey, called in; and Examined.

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YOU are a practical Engineer?—That is my profession, and has been for many years.

Have you had considerable experience in the practice of taking out Letters Patent?—Yes, in assisting inventors professionally, to enable them to bring forward new inventions, and make them practically useful; in advising them how to secure their inventions by patent; in preparing titles and specifications for patents for new inventions; and assisting inventors to support their patent rights at law when disputed. In general, I might say, all those details of professional business that can be rendered advantageous to the interests of inventors; and independently of the technical formalities of obtaining a patent, all those accessory arrangements that can give value and security to the patent when obtained.

Can you explain what is the mode of proceeding in order to obtain a patent?—The only acts the inventor is obliged to perform himself, are the making an affidavit of his having invented the object for which he applies for a patent; paying his money; and afterwards making out, acknowledging, and signing the specification of that invention; all the rest may be done by his attorney, or patent agent, and his professional adviser or engineer.

Are you aware of the different steps that are necessary, from the first application at the Secretary of State's Office, to the sealing of the patent?—I am aware of them, but it is not my business to practise them, and therefore I should not speak to them with the same precision as other persons who transact that business.

By what channel are patents usually solicited?—Many are solicited by attorneys; it is usual for most persons who have made an invention to apply to an attorney to obtain a patent; there are also patent agents who make it their business. Those patents which are solicited by attorneys are divided amongst all that profession; but as the patent agents are continually employed in soliciting patents, and make it their express business, each of them passes a greater number than any individual attorney passes. Of all the attorneys I know, Mr. Abbott, of the Petty Bag Office, has done the greatest number; and of the patent agents, Mr. Moses Poole, of Lincoln's Inn, has passed the greatest number. It is not necessary to employ either an attorney or a patent agent, a patentee might do it himself; I did pursue one myself through all the offices nearly twenty years ago, by way of experiment, to try whether it would be worth my while to do that business in addition to the business

I had

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I had then began, and have since conducted; but I found so much trouble and delay at the offices that I did not find it worth my attention.

Are any of those persons who are employed as agents to take out patents, persons connected with any of the public offices through which the patents must pass?—Mr. Poole holds some office by which all patents must pass through his hands in one of their stages, I think it is in the Attorney General's Patent Office; he passes a greater number of patents than any other person, and I have had the most business with him in consequence; I have found that he obtains patents more expeditiously than some others, and I believe at something less expense; I therefore usually recommend persons who apply to me, and who have no agent that they wish to employ, to go to Mr. Poole.

Is Mr. Abbott connected with any office?—Mr. Abbott holds an office (the Petty Bag) where specifications of patent inventions are lodged, but they do not of necessity all come to that office, and in his official character he has nothing to do with patents whatever; merely to enroll a portion of the specifications which are lodged in his office in consequence of the conditional clauses in the patents.

Do you consider it more beneficial for a party applying for a patent, to make an application to an agent, than to carry it through himself?—Decidedly so, the trouble would be excessive of carrying it through himself, and the preference of an agent to an attorney is, that the agent, by doing a greater number at once, has greater facility; the process is very complicated, and it is necessary to take the papers from one office to another, because when they are lodged at one office they are not forwarded from that office to the next, but they must be taken by the applicant or his agent, and often they are not ready for the delivery the first time he applies for them; I recollect that when I solicited a patent, by way of experiment, it occupied a large portion of the whole of my time, and interrupted all my proper professional studies.

Can you give the Committee any information of the expense necessary in taking out a patent?—I can state the sum totals; for England, I think it will be found to amount to 120*l.*; for Scotland, perhaps 100*l.*; and for Ireland, I think more than 125*l.*; and there is a small increase if the patent for England includes the Colonies. Those are the amounts I always state to those who apply to me for advice respecting the expediency of taking out patents, but those sums include an average of ingrossing and stamps for the specifications.

Does the charge vary with the length of the specification?—With the length and with the difficulty; but the charges that depend most upon its difficulty are not included in the above sums, because professional charges for advice and assistance, in bringing the invention to bear, and specifying it, vary in every degree; I have had them as high as 200*l.* for one very intricate invention, where there were patents for all three kingdoms; and from that to as low as three guineas, where only an examination was required of what had been well prepared by the patentee himself; my brother drew up an average of all the charges we have made in the course of twenty years business, and I think it amounted to about 20*l.* for the specification and drawing to each invention; that was merely the professional charge for all the business relative to preparing the title of the patent, the draft of the specification and the drawings, with duplicate drawings on parchment for the office. The patent agent ingrossing the writing on parchment, and finding stamps. Inventors who employ me, very commonly require more of my professional assistance than merely to prepare their titles and specifications, viz. to advise and assist them to put their plans in execution, make them working drawings, find them proper workmen, tools, old machines to alter for first trials, and to assist at their experiments, &c. but such charges are not included in the above average.

When it is desired to extend a patent to the colonies, is there any difficulty with respect to those colonies that have colonial legislatures?—I believe that it requires an express act of the colonial legislature, to enable disputes on the patent right to be tried in a colonial court of justice, otherwise they would be judged here, which would increase the expense of law proceedings beyond all bounds.

Are you aware of any instance in which a colonial legislature has refused to sanction a patent?—I am not; nor am I aware of many instances in which it has been applied for: the objection to having a patent for England and the Colonies, without an Act of the colonial legislature is, that all law proceedings being necessarily in this country, the expense of bringing over witnesses would be enormous, for an invention which is exclusively practised in the colonies. Those inventions are not very numerous, and hence it is not common to apply for such acts. In

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cases of inventions which are expected to be chiefly employed in this country and only occasionally in the colonies, the inventor might not think it worth while to apply for an act of the colonial legislature. The only instance which has come to my knowledge, is a recent patent to Mr. Hague, for expelling the molasses from sugar; he explained to me, that if law proceedings on such a patent right were limited to suing infringers, in our courts in this country, it would amount to a prohibition altogether; hence he applied for an act of the colonial legislature, at the same time with his patent for this country. It may be stated on that ground, that an invention which is entirely for the service of the colonies, will require an act of colonial legislature, in addition to the patent, to make it available, but they are very few; I suppose, with the exception of that invention, and half a dozen others that have never come into use, there will be no such cases found; there being but few manufactures that are exclusively practised in the colonies. I suppose they would require a separate act for each colony which has a legislative assembly.

What time does it take to obtain a patent?—It is said to be six weeks; but whether they have ever been obtained in six weeks or not, I cannot say; they are certainly now two months upon the average, and that is frequently extended to a much longer period.

During the time between making the application and sealing the patent, has the applicant any security for his invention?—No security whatever; there is even an increased necessity for secrecy beyond that which existed before his application, because his application has called attention to his procedure, and declared what is the object of his pursuit. A man who has proceeded with some freedom in his experiments, and in private trials of machinery, before he applies for his patent, is always obliged to shut up his models, and desist altogether, until he obtains a patent; for by his application, he calls the attention of all rivals to his proceedings, and any disclosure of his invention made before his patent is sealed, (however treacherously obtained,) would be fatal to his patent. It is a common practice of manufacturers, if they begin an invention solely for their own use, without any thought of a patent, when they have obtained such a prospect of advantageous result as to see that a patent would be desirable, they destroy all the models, and every vestige of them, and even send away the workmen who made them, on some distant embassy, to avoid any chance of the secret being called forth by the competition that exists among rival traders as soon as one makes an application for a patent. That is a very great inconvenience, and valuable time is lost to the public as well as to inventors.

Then there are no legal precautions that a man can take against that chance of losing his patent right?—None whatever; and it frequently happens that patents are delayed very long in their progress through the offices, so as to occasion a very great grievance. I had an instance of that recently; I prepared the title for an application for a patent on the 23d of June last, and I am certain that the first proceeding for a patent was taken by the attorney within a day or two of that date; but the patent was not obtained till the 31st of January 1829; what made this peculiarly inconvenient was, that the inventor had made a trial of his invention before he thought of taking out a patent at all, and before he applied to me; I advised him to keep it a profound secret from the instant that he made an application for a patent, and I told him, that it would be from six weeks to two months, that he would be obliged to remain in secrecy and consequent inaction; but it proved to be more than seven months. In the mean time, another person conceived the same idea, and opposed the grant of that patent before the Attorney General, when the progress of the patent was far advanced; that opposition was not made till the 8th of December; and I believe that the invention, upon which the opposition was founded, did not exist at the time when the patent ought to have been granted, if there had been no delay.

Did this extraordinary delay arise out of any peculiar circumstances affecting that patent?—I am not aware of the circumstances, but there were no unusual circumstances attending the invention; it is probable that the King's health might have affected it, as in all cases I know that when the King is indisposed, the patents are delayed at the stage when His signature is required. In this case, the opposition grew up in the meantime, and the applicant was obliged to answer it at considerable expense, and at the risk of his patent being refused, and further delay was occasioned.

The longer the delay between his application and the patent being granted the greater the risk of opposition?—Of course, the greater the risk of opposition and of discovery;

discovery; the above inventor, Mr. Parker, is a lieutenant in the navy, and at that time had no occupation whatever, but he was waiting in total inaction till he could bring this invention forward. It is a self-acting drag, to be applied to travelling carriages, and he had so well digested his plan, that he was ready the very day after the patent was sealed, to begin to work with great vigour, and the thing was applied to a carriage, and tried in a short time after his patent was sealed; but if he had done so, in the time between applying for and obtaining it, he would have been subject to the loss of his patent, for the plan could not be concealed when it was taken out to try it on the public roads.

Are you aware of any other instances in which opposition to the patentee has arisen from new inventions which have grown up between the time of his making application for a patent and the time of his obtaining the patent?—That must be rare, because the instances of such long delay are not very common, and the chance of similar inventions growing up in the meantime is a combination of circumstances that is not likely to occur frequently. I submitted to the Attorney General, when I appeared on the part of Lieutenant Parker, that we ought not to be called upon by opposition, from the circumstance that the invention by which we were opposed, had been made after the period when we ought to have had our patent granted; he took notice of the objection, saying, that we should have the benefit of it, if he should be of opinion that the inventions were the same.

Supposing, from any circumstance, a delay should inevitably arise between the application and the sealing of the patent, the Attorney General has no means of securing the invention?—He has no means; I suppose that he might have refused to have entertained this opposition, but he did not decide whether he would or would not refuse the opposition, because he made an inquiry, and got rid of the opposition by another means, viz.; that the inventions were not so similar as to prevent the patent. There were instances during the late King's indispositions, when no patents were granted for many weeks together, and oppositions to patents then in progress, must no doubt have arisen in the intervals of delay, but I have no knowledge of them, or how they were treated by the Attorney General at the time.

Then the object of keeping an invention secret after it is determined to take a patent, arises out of these considerations; first, lest the invention should be pirated; and secondly, lest there should be such an act of publication as to vitiate the patent?—And also the risk of calling up an opposition to the grant of the patent; because the instant that any man, by any means, announces to his competitors in trade that he is engaged upon a new invention, they are all upon the watch to find out what it is, and if they know only the object of it, or what part of his processes it relates to, they can examine into the circumstances of their own processes to find out something for the like purpose, if not the same. Therefore it always happens, that when a patent is applied for, on any new subject, that there are several other applications for patents upon the same subject, following each other very quickly.

Do you not word the title obscurely, in order to avoid directing public attention to the subject?—Yes, but there is a danger in being too obscure, because then a court of justice may afterwards hold that it is an invalid patent, for want of coincidence between its title and the specification. It is one of the most metaphysical problems that I know, to prepare a title to a patent; it generally takes me two or three days to make up my mind about the wording of a title; not to be so clear as to call the attention of rivals, and enable them to discover the subject, and not so obscure as to incur the danger that a court of justice may afterwards rule, that it is an imperfect definition or title of the invention described in the specification.

Do you see any remedy for that inconvenience?—The remedy is obvious: to make the right of the patentee secure from the time he makes his application; on condition of his then lodging a paper of the heads of his invention—a statement of the principle on which he founds his invention; that is the case in Spain. Another obvious remedy is, that the final specification and description of the means of executing the invention, should be engrossed in the patent itself, so that the title of the patent, instead of being the only means of reference between the two documents, should become a mere indorsement, and a matter of no importance: the latter is done in France. As our practice is now, if the Judges cannot find in the title of the patent what has been called a general index of the specification, the whole patent is set aside. The difficulty of making a correct general index to a work which is not yet composed, must be very great.

What constitutes such a publication during the interval between the application for the patent, and the sealing, as to vitiate the patent?—That has never been

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declared by law, or decided with precision; and my advice to inventors is, to keep their secrets as close as possible. It is supposed that an invention communicated by the patentee to any person whose assistance is necessary to carrying on the invention towards perfecting it, would not be considered as a publication. When an inventor brings his invention to me, and communicates it to me for professional advice, that is no publication; and if he communicates the same to a workman, or to only so many as are fairly necessary, in order to make a machine or a model; but it has never been decided, whether if those persons were to communicate it at second hand, that would be a publication or not; I apprehend it would, though it is probable that the inventor would have a remedy against those persons by action for damages. In the absence of any decision of the Judges, I suppose from the concurrent opinions of counsel of eminence, that such breaches of trust would be considered as publications. It has never come before a court except once, and then I believe the matter was settled in such a way as not to give the positive opinions of the court on the subject. Whenever an invention, or a new article produced by an invention, has passed from one person to another by sale, before the date of a patent, the patent cannot be maintained. There is a decision on this point. The inventor of a new mode of making verdigris, manufactured and sold the article before the date of his patent, which was afterwards set aside in consequence. In this case the invention being the mode of making the article, that invention did not become known by such sale, and therefore the substantial claim to a patent remained; viz. the power of the inventor to withhold his invention from the public.

If a person having made an invention of the same nature as that for which a patent is sought, and has carried it on secretly, is it supposed that the previous secret exercise of the invention will vitiate the patent?—It is decided that the secret exercise of an invention would not vitiate the patent; but then it is assumed that the person so carrying it on secretly, would inevitably reveal the secret the moment that he knew that a patent was applied for, and a disclosure of the secret by him, in the interim between the date of the application, and the date of the patent, would vitiate the patent; that is the only reason I know, for leaving the patent open to destruction by a publication of the invention, between the date of application and the date of the patent; viz. that those persons who have been previously secretly practising the same invention, may have an opportunity of publishing it, so as to destroy the patent. But such publications from the fear of an expected patent, rarely take place, because, when a person applies for a patent, he does not declare himself so clearly by the title, that the person secretly practising the same invention could be certain that it is identical with the previous secret practice.

Is it supposed that the exclusive right given to the patentee will be valid against another party previously exercising the same invention secretly?—It is generally assumed to be so, but I am not aware of any law, or decision upon that point, and it could scarcely come to the test, because the same secrecy that would enable him to have hitherto concealed his process, would also prevent any legal proofs of his having infringed the patent; it is exceedingly difficult to obtain sufficient proof of infringement. Many patents are infringed for years together, without it being possible to obtain any redress, from the difficulty of proving the exercise of the identical invention; that is only the case in a peculiar class of inventions which admits of secrecy; they are mostly chemical operations, where the whole can be done by one or two hands. The Court of Chancery is said to have a right to compel a man to disclose his processes, to inspectors, appointed by the Lord Chancellor to ascertain whether he has infringed a patent or not; I know that the late Lord Chancellor appointed two engineers to go and inspect machinery, but I believe the party consented to the measure and nominated one of them; I never knew such inspection ordered respecting processes; and I doubt the power of the Lord Chancellor to enforce such an order, which would be a nullity if a person did not choose to operate before the inspector, or operated differently from his usual practice; and if he chose to take a machine to pieces and destroy or conceal the parts, there could be no remedy.

Would a more correct specification of a patent invention, make it more easy to prove an infringement?—No; the difficulty of obtaining proof does not depend upon the incorrectness of the specification. If the specification is incorrect, the patent is set aside on that ground; but the specification has no other operation to the advantage of the patentee, than as it is necessary to support the patent right.

You have said, that where a man's secret is betrayed, he may have an action for damages;

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damages; are you aware of any case in which such an action has been brought?—I have some confused recollection of proceedings many years ago; I cannot recollect whether it was an action, or a bill in Chancery; it was for a breach of trust; that is the only instance that I know of any proceedings upon such a subject; it was between Smith and Dickinson, I think, in 1803. I find, on examination into that case, that the person who committed the breach of trust did not publish the invention, but took out a patent for it in his own name, and kept it for his own benefit, instead of for the joint benefit of both parties, as he had promised to do. £.300 damages was awarded in the Court of Common Pleas, and the patentee was also compelled to assign the patent to plaintiff. The validity of the patent obtained under those circumstances was not decided; but as it was probably bad or suspicious, the damages might, in the intention of the court, be a compensation to the plaintiff for impairing his right to the patent, which was assigned at the expense of the patentee, and therefore if it had been good, that would of itself have been compensation.

What means have the public of becoming acquainted with the fact, that an application for a patent has been made before the patent is sealed?—None whatever; but individuals who choose previously to lodge a caveat, will certainly have information of any application that may be made for a patent, in terms corresponding to those of their caveats. No publication of applications is made.

Can you give the Committee any information with respect to the caveat?—The caveat has no other operation in favour of the person who lodges it, than that which ought to be given to the public at large, by advertising the application for a patent in the Gazette; it gives notice to parties who have foreseen that they shall want notice.

Of what benefit is it to the person who enters that caveat?—If he require to have notice of a patent being passed, that caveat will give him notice.

Is it not a request that information should be given to him of an application for a patent?—Yes; a patent cannot pass through the office where a caveat has been lodged, without notice being first given to the person who lodges the caveat.

Supposing he opposes the patent, what steps does he then take?—If the ground of his opposition is, that he has practised the same invention before, or has a previous patent for it, he may cause the Attorney General (or Solicitor General, according to which office it is in) to summon the parties, and the Attorney General, after examining the respective inventions, decides whether they are so dissimilar that the patent is to pass, or not; that course applies equally, whether the opposing party previously had the invention in common use without any patent, or whether he has a new invention in hand, for which he proposes to take a patent, or whether the invention has been surreptitiously obtained from him by the applicant, or whether the opponent has already taken a patent. The caveat has the same effect as the standing order of Parliament, whereby a notice must be given in consequence of an application to Parliament for any private bill; but with this difference, that there the notices must be given, in due time, to all parties interested, whereas in this case it leaves parties to foresee that they shall want notice, and to provide for obtaining such notice by lodging a caveat.

Will you explain what protection it is to a person applying for a patent to lodge a caveat?—In general, it is no protection whatever. If a patentee, after having disclosed his invention to some agent, or associate, or patron, before applying for a patent, has a suspicion that such person might be applying for a patent himself, at an earlier period than he, the inventor, was ready with his application, then by lodging a caveat, he would have notice and detect the treachery, before it was too late. I know no other use that it is of. When persons apply to me for my advice respecting a new invention, and ask whether they should or should not lodge a caveat, I inquire particularly, if they have ever communicated it to any person except myself, if they say no, then I take no caveat; if they have communicated it to any other person, I inquire into the particulars, and if there is the least probability that opposition, or rivalry, may ensue from those parties, then I recommend a caveat; because otherwise those parties may apply for a patent before we can; except in such case, the lodging the caveat might be a bad measure, by calling attention to the inventor's proceedings; for although he may conceal his name by using that of an agent, still his application for a patent is not so likely to get known, as his caveat; because any person can be informed at the offices what caveats are entered, but not what patents are applied for, and in progress; unless they have

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entered caveats, and have notices in consequence of them, they cannot learn at once what patents are going through the offices.

Would not the effect of a previous caveat be to debar the original inventor from taking out a patent?—No, the caveat makes no opposition of itself; it merely causes notice to be given to the parties that such a patent is applied for, and will pass if not opposed; there are no proceedings upon the caveat itself, further than the clerk of the Attorney General, or other office where a caveat is lodged, sending a notice; I have had such notices continually, but my caveats are now commonly lodged in the names of solicitors or patent agents; because I am often out of town, and the notices require immediate attention.

Supposing the case of two applications for a similar invention, would not the effect of that be to destroy the right of either party?—The only decision upon that is, that the first applicant is to have the preference; it would be scarcely possible that two should apply at the same instant of time; and priority of application is preferred to priority of invention, that is, assuming each one to have invented independently of the other. If one is a plagiarist, the true inventor would have the preference, although he was not the first applicant; that is, supposing he desired to have a patent; if not, then, according to my notion of the spirit of the existing law, the first applicant who is able, and willing, to make the disclosure of the secret, ought to have the patent, that is to be given as the price of such disclosure. The first inventor ought to have the refusal, and if he declines it, then the first applicant should have it; but in all cases the disclosure is to be induced, either by the recompence offered by the grant of a patent, or by publication made in time to vitiate an expected patent, about to be granted to another. I cannot say that this is the established practice, for as far as I can judge from what I have seen, no two Attorney Generals have had the same view of the subject. There is no authority whatever in writing to go by.

In giving a preference to the first applicant, it is assumed that the invention has not been practised openly by either?—Upon any person proving to the Attorney General that an invention has been publicly practised before he would refuse the patent altogether.

In case an applicant for a patent was aware that some one else had turned his mind to the same subject, would it not be of service to that person to lodge a caveat, in order that he might have notice if his rival made previous application for a patent?—That is the common case of a caveat being lodged, but it can do no great good in most instances. If a new invention is getting up so much in secrecy, that none of the rivals are informed of its existence, then a caveat has only the effect of calling attention to the subject; but if attention has been already called to the subject by other means, then a caveat has the effect of procuring a notice of any rival application.

What is the form of the caveat?—The form of a caveat runs, "Caveat against a Patent being granted to any person, or persons, for any invention (in the subject of inquiry, for instance) in cotton spinning, without previous notice being given to Mr. ————" that may be the real person or any agent; the address where to direct the notice, is all that is essential as to the person.

How long does that caveat run?—Six months.

What is the expense?—The expense is five shillings at each office; and there are three offices where caveats may be lodged.

Suppose that there are two applications for a patent, and the Attorney General informs the parties that the inventions are the same, and awards the patent to the first applicant, is it not in the power of the rejected applicant, on receiving that information, to effect such a publication as will destroy the patent right?—It is in his power; but I never knew an instance where the Attorney General did declare that there was such a similarity and equality of rights to a secret invention, as to induce him to refuse granting a patent; he has sometimes advised the parties to join their interests in one patent, when he felt difficulty in deciding, and has informed them that by contending at law, their patents, if he allowed them both to pass, would probably destroy each other. In the case of Lieutenant Parker's carriage drag, the opposition that I mentioned before, which was heard on the 8th and 9th of December, the patent having been applied for in June, it was supposed at the time of that opposition that his patent was very near its completion, and the other inventor, who had conceived the same or a similar idea, having been in the habit, some years before, of consulting me, and my brother, came up to London to apply to me. The moment he opened his papers, I said, that looks so very like to a plan which I have in trust, that I cannot undertake to advise you; but if you think of

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going on, apply to Mr. Millington, which he did. In that case, the person making the opposition knowing, from what I had said, that there was probably great similarity, proposed to Lieutenant Parker to make it a joint patent, to which I should have agreed on his part, if the second invention had grown up from equal date with the first; but as I thought it came too late, and when we ought to have been out of the reach of opposition, if no delay had taken place, I refused, because I expected I could prevail on the Attorney General to quash the opposition, as coming too late; the opposing party therefore prepared to be ready to publish the invention the moment the Attorney General should say they were the same, so as to destroy the patent, which would otherwise have debarred him from using his own invention. The Attorney General, however, after hearing and rehearing several times, decided that there was such a similarity as to make it a case of difficulty, but that there was not such a similarity to justify him in refusing the patent; in consequence, the opponent, thinking there might yet be novelty in his plan, reserved it, to see whether when Lieutenant Parker's specification was lodged, that there would remain any difference, or invention worth his taking a subsequent patent. In this same case, the Attorney General said, that as there was so much similarity, Lieutenant Parker must give him a drawing of the drag that was exhibited, to keep by him, in order that he might have a check against any more invention being put into the final specification, than what had been exhibited at the hearing; that was an extra and unusual expense, to require such drawing, and a hardship to forbid the patentee from making further improvements in the details of carrying his invention into execution, during the term allowed for preparing his specification. It has since that time been clearly decided by the Judges, that an inventor has a right to make further improvements during that period, so that he does not superadd any new principle, that decision was respecting Clegg's patent in January last.

Is the Attorney General the sole judge between two patent applicants?—He is; he summons the parties before him; they bring their drawings and models, engineers, witnesses, attornies or agents, to explain; and sometimes, if it is requested, he will go and visit the machinery.

Does not the sort of decision he is called upon to pronounce, require considerable knowledge of mechanics?—It requires a very deep knowledge, to form a decision between the merits of the respective inventions, particularly as the inventions at the period when they must necessarily be exhibited to the Attorney General, are seldom organized in that state of perfection that will enable him to judge by results only. Inventors can rarely have any chance of making their ideas intelligible to the Attorney General, and hence they are obliged to employ some professional man who can devote more time, and more readily make out what they mean by their imperfect models, drawings or descriptions, and then attend the Attorney General to explain for them. I have been thus in the habit of attending all the successive attornies general since the time of Sir Vicary Gibbs, but was never required to leave any drawing or description, except once, by Sir William Garrow, and in the case last mentioned.

Can you state whether it is the practice of the Attorney and Solicitor General, in cases of difficulty, to call in any assistant by way of an assessor?—It is not the practice, and I should doubt the propriety of his exercising such a power, if he possesses it; because an inventor would think it very objectionable that his inventions should be communicated without his consent, further than to some public officer, such as the Attorney General, who can have no interest in it, or else to a confidential professional man of his own election.

Is it not an inconvenience that a question between two concurrent applicants should be decided by a person, perhaps, not very competent to decide such a question?—It is not a felt an inconvenience, from the circumstance that the Attorney General almost always sees sufficient ground of new invention, to grant the patent, or both, if two are applied for; therefore the oppositions become of no effect, and I never recommend any for that reason; the result is, that a man can get a patent for any thing, unless it be a notoriously old invention, and even then very slight alterations will make it appear new to a person unacquainted with inventions.

So that it is a mere formality?—Yes; if any of the attornies general that I have attended (unless the present Lord Chancellor might be excepted) had attempted to exercise a judgment between contending inventors, it would have been very mischievous in frequent cases, and never any good; the patents being at all times subject to be annulled by a court of justice, if not found to be good in every respect: the Attorney General recommends the King to grant the patent almost

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uniformly; and upon the same assumption, if there are two applications for patents for very similar inventions, he allows both patents to pass, when there would be a chance on very close inquiry, by competent judges, of finding collision. It is usual to advise the parties to join in a patent, but nothing more. If the invention has been communicated, so that they have sprung from a common origin, and if there is some proof of that communication, justice may be done to the first inventor, if he desires to have a patent. The chance that there should be at the same time two independent inventions exactly the same, is so small, that it can only happen very rarely, in the course of things; and cases of collision are usually the result of piracies more or less flagrant.

Is it not the practice for a person applying for a patent, to present his petition at the Secretary of State's Office?—Yes, that is the first process; the petition being accompanied by an affidavit, to give authenticity to the allegation.

Is not that petition referred from the Secretary of State's Office to the Attorney General?—The agent must fetch it from the Secretary of State's Office, after it has received an indorsement on the back, containing a reference to the Attorney General, or else to the Solicitor General.

What is the object of that reference?—It is to have the Attorney or Solicitor General's opinion, on the propriety of granting such a patent as the inventor requests.

Does not that reference assume that some discretion is exercised by the Attorney General in regard to granting patents?—Unquestionably: I suppose that form of reference is not peculiar to patents, but it is very likely that other applications to government for grants from the Crown, are referred in the same form to the law officers, or other servants of the Crown, who may be best qualified to give sound advice upon the subject.

What is the nature of the affidavit accompanying the application to the Secretary of State?—The affidavit is, that he is the real inventor of that, for which he applies for a patent, and that, to the best of his knowledge and belief, it has not been used by others, and will be publicly beneficial.

In point of fact, the discretion of the Attorney General is not exercised upon the subject?—There is a discretion of some sort exercised, for instance, when a patent is applied for, during a time of war, for any invention which might have a material influence upon the public service, an inquiry is made, as to how far it would affect the King's service; and in many patents for inventions relative to military or naval affairs, there is a clause in the patent, that the patentee shall be bound to furnish all that may be required for the public service, at such reasonable prices as shall be settled, I think, by the boards in each service, such as the Navy Board or the Ordnance Board. In those points which might affect the interests of the King's service, discretion was exercised.

When the patentee comes before the Attorney General, he has to give a general description of the nature of the invention?—In case of opposition, but not without; and it is a great evil that the applicant is no way fixed to what he does intend to specify. There have been some speculators or patent jobbers, who the instant that they find out that a person of talent is occupied with an invention, apply for a patent, with a title sufficiently general to cover the invention; and having thus got the start of the inventor, if they can by any means get at the invention before the time of specifying, they have a good chance of making it their own; for even if the real inventor gets notice, and makes opposition, he is the second applicant, and is almost always obliged to make it a joint property, because unless he can prove the fact of the plagiarism, the Attorney General can rarely be convinced of the identity of the same invention, when differently explained by two parties, with different models or drawings, and when one party has an interest in disguising the similarity; or that party may purposely describe quite a different invention to the Attorney General, who keeps no record what it is, that the applicant applies for, or describes verbally, in case of opposition, further than as it is expressed by the title of the patent; hence, after having either from ignorance of the real invention, or from design, made a fictitious explanation to the Attorney General, he may get the real invention by treachery, and put it into his specification. A patent was granted on the 29th November last (but is not yet specified), it is intituled, "For certain Improvements in the construction of Steam Engines, and the Apparatus connected therewith;" the patent gives eighteen months to prepare the specification; now whatever that patentee can find out, by any means, in the course of that eighteen months, (or perhaps during two years, dating from the time of his first application,) that will be covered by this comprehensive title, he may bring it forward

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forward in the specification, and nobody can prove that he did not possess the invention, at the time of his application.

Is the principal point that the Attorney General takes into consideration, whether the title of the patent applied for, agrees with the title of any other patent, concerning which a caveat is lodged?—His clerks do that, the Attorney General himself cannot enter into such details; if the clerks think that the application for a patent corresponds with the title of any caveat lodged, they send a notice. In judging of that correspondence between the title and the caveats, they are very liable to be mistaken. If no steps are taken in a certain time in consequence of the notice, the patent is allowed to proceed; there are, I believe, three days allowed to send answers to a notice sent to a person in town, and, I think, five days in the country, during which time they keep the patent waiting for opposition to be made, if any person chooses; opposition may be made by any person who applies in time, without a previous caveat, or notice to that person.

You recommend that the patent should be secured to the applicant from the time he makes his application?—Unquestionably; that is, I do not contend that the patent should be secured to the inventor at that time, against all objections that might be to the grant, but it should be secured against the effect of treacherous or rival publications of the same invention, before the sealing of the patent.

In case that improvement were adopted, would it not be necessary to make an alteration in the course of proceeding in other respects: for instance, would it not be necessary to make the applicant for a patent, lodge a specification at first?—Certainly, a kind of temporary specification of principles; that is the case in Spain; and in France and America, the complete specification is required in the first instance.

You mentioned the inconvenience that is felt by inventors, from persons whom you call patent jobbers, what remedy would you propose for that?—To fix every applicant, as is done in France and America, by some specification in the first instance; only that I would not recommend a complete specification to be then required, but a temporary one, containing a definition of the principle and object of the invention, leaving the patentee afterwards to prepare a more complete specification when he had organized, and proved, the means by which the invention is to be carried into effect; that final specification should be examined, and ought only to include such matters as are, in the opinion of competent examiners, a fair extension of the statement of his original idea, as expressed in the first deposit. As it is now, the patentee is not obliged in any way to declare what his invention is, till he puts his specification to the patent previously granted to him, and in the meantime he may change his plan within all the latitude that the generality of the title will permit.

Would you advise that a person applying for a patent should have his specification ready at the time of his first application?—Not his complete specification; that is done in other countries, but would be impracticable here; because the spirit of rivalry and competition is so strong, that an invention cannot be put to the test of experiment, or brought to bear in secrecy, so as to enable an inventor to defer his application until he is prepared to specify properly; that may be done in foreign countries, where secrecy can be more readily preserved, but not here. The specification, with all the details of description necessary for instructing the public how to practise the invention, cannot be made, till the invention has been actually practised; I recommend that the inventor should lodge a statement of the particulars necessary to define the principle, and explain the outline of his invention: for instance, if it is an improvement in the steam engine, he should state the part of the engine to which the improvement is to be added or applied, the *modus operandi*, and the effect it is to produce; so that when the complete or real specification is afterwards made out, it can be decided by competent judges, whether it is a fair developement of the ideas originally recorded in the provisional definition.

Is not great inconvenience experienced from the circumstance, that after the application and before the enrolment of the specification, the applicant is precluded from proceeding with his invention?—There is; and also from the difficulty of making such a title as will, in the opinion of judges, correspond with his specification; he is subject to the danger of losing his patent afterwards.

Would it remove that inconvenience to secure the patent for the invention, to the applicant, without a distinct specification at the time of the application?—It should be a provisional, or outline specification, with security that during the time allowed for preparing the complete specification and granting his patent, he should be protected against the effect of any publication of his invention, but not against infringements of it. No infringement of any importance could arise in three or four months,

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in a new thing; the great danger is now, not of people infringing his patent, but of their publishing the invention, and thus destroying his right to the patent; and perhaps the publication may not be made, until after he has paid three fourths of the fees for a patent thus rendered abortive.

You would compel him on applying for his patent, to lodge a statement of the principles to be afterwards developed in the specification, and you would require that when the time has arrived for the enrolment of the specification, and consequently granting the patent, he should give the details, to be transcribed into the patent itself?—Yes, the knowledge of those details does not always exist at the time most proper for applying for the patent, and therefore it is impossible that they should be described, nor will they come into existence, until the thing has been put into practice; as it is now, the two months which elapse between the time of applying for the patent, and the time when the patent is granted, are lost, as to any such creation of the means of putting the invention into practice, and therefore the patentee has in fact only the remaining two, four or six months, and in that time he must prepare his specification as best he can.

Would there not be a difficulty in securing to any one, a property in what was not distinctly defined?—For a permanency it would be an excessive difficulty, but for the short term of two or three months, it would not be any inconvenience to give a right, that is completely defined, and in some degree described, by the outline of a specification: in Spain the practice exists. In fact, every patent now granted, is in force for two, four, six and some for eighteen months, before there is any definition whatever, of the right it confers; but that is an evil, as I have shown.

You mean that he should be not only authorized, but compelled, in the first instance, to give a specification something more precise than is frequently now given?—Certainly. In the Spanish law it is optional; but I think it should be an essential condition for the first step; no record at all, is now given in the first instance, nor is any writing usually preserved, in case it is explained to the Attorney General, upon hearing of opposition.

And you would require this greater precision in the meaning of the first application, not for the benefit of the applicant, but for the benefit of other inventors?—For the benefit of all inventors that are occupied at the same time, on the same subject; it is an intolerable nuisance to persons who are engaged in speculations, that they are perpetually in danger of having their inventions or improvements stolen from them, and put into the specifications of some existing patents, not yet specified, but which have titles that will cover their inventions. Such undefined patents are like legalized receiving houses for stolen goods.

Are the inventors whose ideas have been so appropriated by previous patentees, called upon to prove the negative that the patentee did not invent what he specifies?—Yes; they must prove that the invention was in use before the date of the patent; or that it was communicated surreptitiously from them to the patentee after the date of the patent; their proving that they invented it or put it into use themselves after the date of the patent is not sufficient, because the invention became the property of the inventor from the date of the patent, although he is not called upon to declare what it was for a long time after.

Is there any limiting law to the time which is allowed for the specification after the issue of the patent?—None by law; by custom it is two months for each patent; thus upon a patent for England two months is allowed, for England and Scotland four months, and for England, Scotland and Ireland, six months; of late years, on declaring in the first instance that they mean to proceed with patents for England, Ireland and Scotland, they obtain six months at once in the English patent. I believe they must take some of the first steps towards applying for those Scotch and Irish patents, and must incur some expense in consequence, but they are no way bound afterwards to proceed with the Scotch and Irish patents to completion. It is quite discretionary in the Crown how long time should be allowed, and on special showing (I believe, to the Attorney General) longer terms are occasionally granted. The patent I have mentioned for improvements in steam engines is eighteen months; there were several eighteen months patents granted ten and fifteen years ago, and great complaints were made of the evil. I was employed in 1816 by parties who had just got a fifteen months patent sealed for themselves, but not specified, to draw up arguments and instruct counsel to complain of another such patent then in progress being granted, with the same time, to their rivals in trade, and to oppose that second patent being sealed by the Lord Chancellor, on the public grounds I have before stated. Although the Attorney General had made out and passed it, as far as he

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he was concerned, Lord Eldon refused to seal the patent as being very improper, and intimated that no more such patents should be sealed, and there have been none till this recent instance. I do not mean to say that this patent is any intentional unfairness, for it is granted to Colonel D'Arcy, the executor of the real inventor, who is dead, and hence I suppose he showed to the Attorney General that there was some necessity for the unusual time, to get the papers of the deceased together, or to examine his manuscripts; but the principle of granting an undefined legal right to be in force for a year and a half, without definition, needs no comment. The old pretence for such long time was to get time to apply to Parliament to have the specification kept secret, in order that the invention might not get to foreign countries.

Do you see any inconvenience in allowing a long time for the specification?—It is essential to getting sufficient specifications made of important inventions, to allow a long time; and on the other hand, it is an excessive grievance to persons engaged in like pursuits, unless some provisional definition of the legal right, that is conferred by the patent, were to be made public.

Would not the grant of a long time for the specification, enable a fraudulent party to avail himself, for a limited period, of the patent without revealing it to the public?—It might; but even eighteen months would commonly be of no value at the commencement of a new invention of any importance; because it is so difficult to begin at first, and only occasions expense instead of profit.

Are there not many inventions that are only valuable for a short time?—Very rarely; they must be very evanescent inventions; such as the kaleidoscope, and the hobbyhorse called velocipede, which must necessarily be of no value to the community; I consider that such patents are of no public utility.

Are patterns ever the subject of patents?—No; but it is not well defined, nor is it easy to define, what degree of invention shall or shall not be the subject of patents; it is very desirable that patterns should be protected in some ready way, but not by patent; it would be too expensive and tedious.

The greatest length of time for which a patent can be granted is fourteen years, is it not discretionary with the Attorney General to grant it for less if he pleases?—I am not aware of the fact, but I suppose it is.

Would it be advantageous to the public, that patents might be taken out for a shorter time than fourteen years, supposing that there was a correspondent diminution of expense?—That is the practice in all other countries, but I am scarcely prepared to make up my opinion upon it; it would tend to multiply the number of patents for trivial inventions, which I think is not desirable, because they occasion so much litigation, and that evil would remain, if patent rights were rendered more secure by better law. Shorter terms, at less cost, would be utterly unavailable to patent rights for inventions of importance, which so much require amendment at present; because there the evil is, that fourteen years is too short. In my opinion fourteen years of profitable exercise of an invention is always sufficient, if it has not been preceded by loss that is to be repaid. The question is, whether a part or the whole of that term may not pass away before the profitable exercise begins. An invention which has no such term of unprofitable exercise, might be very well repaid by five years, as in France; but if it is an invention of any importance, there is always a period of positive loss and outlay, and then another period of unproductive exercise, before gain begins. The difference of cost between a five years, and a fourteen years patent, would be of no consequence to patentees of important inventions, where a great outlay of capital is always contemplated. I do not see how the public are ever to get any benefit from it. Patents for profitable objects would always be taken for the longest term, and unprofitable ones become extinct of themselves. It would be only enabling the patentee to save a small sum of money, and inducing a poor man, for the sake of doing that, to forego a part of the advantage he might derive from his invention. My observation supposes the length of the term to be left to the option of the patentee; if the term could be adapted to the nature of the invention, by a discretionary power, very great benefit might arise, if that discretion were wisely applied; but as there is every chance that it would be misapplied, and would then do excessive injustice and injury, I would by no means recommend any such discretion.

Does not it often happen, that after a person has taken out a patent for an invention, he makes some material improvement in the invention which at present requires another patent?—It is a very common case for the same invention to require two, three, and four successive patents; and it is a very great hardship, it operates prejudicially to the public as well as to the inventor. I have known a case

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where an inventor obtained a patent, and not more than a week after lodging the specification, he made a material improvement upon what was specified; the improvement is so great, that it would supersede his present article, which is a good one, and sells well; and yet if he practised the last and best edition, his former patent might be brought in question, and therefore he keeps it a secret, and does not practise it at all; some time or other he may apply for a new patent, when his old one is expiring, or by his death it may be lost.

In such a case, would not the inventor be in a much better situation, supposing he had taken out a patent for five years, with the power of adding his improvements to the patent, so as to make it then a patent for fourteen years?—If you grant patents for a short period, and allow them to be extended, on paying fees and adding new improvements, there can be but little objection to that; it is the system now in use for the copyright of books, nor do I see any advantage; because reducing the cost in the first instance would come to the same thing, which, as I said before, is objectionable, so long as there is no other check to the excessive multiplication of patent rights, than the cost of obtaining them.

Would not the arrangement proposed in the last question be an advantage in such a case as you have mentioned?—No; because that case merely requires successive specifications to be received, as improvements arise; the last specification, like a man's last will, to be definitive. That is an important arrangement, which is established in France; there, as improvements arise, successive specifications of those improvements can be added (at very little expense) to the original specification, and thus give validity to the patent, even though the first may have been imperfect.

Would not that be very advantageous?—Very advantageous indeed; here there is no remedy for a defective specification at present. When a patentee is compelled to specify his invention within six months, which is the longest period that can be obtained in ordinary cases, if he is not then prepared to specify his invention, with all its details of execution, in a perfect manner, his patent right must take the chance of his imperfect specification; and although he may come to know how to make it perfect the next day, he has no remedy whatever; he has no means of putting upon the roll that additional perfection which he attained in the means of execution, even the next day after specification was enrolled; and if he practises the invention in a better manner than that which he specified, instead of its being held that he is deserving of public approbation, for having pursued his course of invention further than at first, the courts of law assume that he has committed a fraud, by concealing something which he ought to have put into the specification.

Supposing he makes an improvement in the course of two or three years after taking out his patent, what is the effect of that?—The effect is the danger of overturning his patent, if he practises the improvement, or departs from his specification in his practice.

In such a case, would not the ground upon which the patent was overturned be upon the supposition, that at the time of his making the specification he concealed something with which he was acquainted?—Yes; and he can only refute that imputation by proving in evidence, that the specification described does contain sufficient instructions to enable the public to exercise the invention with full advantage. It is impossible for him to prove the negative, that he did not know the improvement at the time of specifying. When a man invents and takes out a patent for a steam engine, steam coach, or a lace machine, or a mule to be worked by power, six months is the utmost he can get for preparing his specification; he uses his utmost exertion to get his engine made, and put to work, before the time when the specification is due, in order to make a trial of it, and regulate his specification by that trial; perhaps just before the time when he is expecting to get it to work, some part fails, or requires to be re-made, which prevents his making any trial, and the time being come, he is not able to try his engine before he must put in his specification, which he therefore makes as well as he, and his adviser can guess, without any trial, though he has gone through nearly all the trouble and expense of a trial; then a few days after, having enrolled, he finds out, upon experiment, some most important improvement in the means of carrying his invention into effect, which either had not occurred to him before, or if he had thought of it, he could not have safely put it into the specification, because it was a mere speculative idea. If he had put in that speculative idea and it had turned out on subsequent trial to be wrong, it would be said in a court of law this was a blind, this is nonsense, to mislead the public from the real invention, which he reserved for his own private practice.

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In that case the inconvenience arises from want of time?—Yes; and the expense of those hurried proceedings, to get a sufficient trial of new machines to enable us to specify properly is excessive, being frequently obliged to keep people working night and day. I have sat up all night many times myself, for such work, and have undergone such fatigue, that I could not be any way sure of what I was doing. Even when a successful trial has been accomplished, there remains so little time afterwards, that the specification must be composed in such haste as to run the greatest risk of some inaccuracy or error.

Supposing a specification to be so accurately drawn as to be sufficient to inform the public how to use the invention at the time that the invention is enrolled, and that subsequently to that, the inventor discovered some improvement in his invention, his patent is not forfeited by his using that improvement?—No, not by law; but he must prove that his original invention would answer the purpose proposed, and be a useful and beneficial practice, and the fact of his departing from it, is presumptive against him; therefore in such a case, when the right comes to be tried in a court of law, the inquiry does not turn upon the real patent machinery that is in actual use, doing business and public good, but it is necessary often to make old-fashioned and obsolete machines that have been described in the specification, but have been superseded by better ones, and are of no use whatever except to satisfy a court of law, that what was specified will really do; and if by such evidence the court can be persuaded that they will do, then, however inferior they may be to the more recent editions of the inventions (which they never examine,) the patent escapes from being set aside for want of sufficient description. If the opposite parties can persuade the court that the machines described will not answer, then the patent is set aside, without any inquiry into the real merits of the invention in its modern form, and that which is in daily use, and is the subject of the action.

Is it not quite fair that the patentee should be bound to give such a specification?—Unquestionably; but when an inventor's patent is set aside because he has not fully described his invention, it ought to be on the ground that the secret has been withheld, so that the public are really not in possession of it, and have consequently not derived the benefit of such possession. Instead of making ridiculous inquiries whether an obsolete specification, is so defective as to destroy the patent, it should be amended by a new one, corresponding with the improved state of the practice. On the other hand, if the public are really in possession of the invention, and deriving benefit from its exercise, whether they became possessed by means of the old specification or not, the patent ought not to be set aside. It is law, that if a patent invention is insufficiently described, the patent cannot be maintained; that is, where the specification does not contain such information, that persons conversant with that art can practise the new invention with real advantage, and quite as much advantage as the patentee practised it at the time of recording the specification. That remedy for a bad specification is merely penal, and the public has no advantage from it whatever; they do not get any more complete specification by annulling the patent. If the patentee were to be compelled to bring a better specification, there would be a real advantage; and if he refused to do so, then the present penalty of forfeiture would be very properly applied.

Do you think that the public would have any security against those imperfect specifications, by the appointment of a commission to examine the specification before it was enrolled?—It would be very easy to have specifications examined and verified either by a competent commission, or by suitable referees. The courts of justice now trust to the examination and opinion of others, but they do it in an improper manner, because it is by parties, brought by interested individuals, and when it is too late to amend any defects. It is quite a branch of my business, where there are any disputes upon patents, to examine and speak to the precision or defects of the specification; where there is any doubt about it, I always have machines made in exact conformity with the drawings, and put them to the actual test. The expense of doing so is very great. A case occurred very recently of a patent invention, for which I had made a specification in the year 1816, Clegg's Gas Apparatus, since called Crosley's Meter; it was just such a case as I have been describing, where the men had been working night and day to get machines to work before specifying, and only one out of two could be got to trial, consequently a specification was made describing the untried meter, in such a manner as we thought would be most likely to answer in practice when the experiment was made; but after that experiment was made, it became apparent that some things that we supposed to be the best were not the best, but as we put the whole in, the specification proved sufficient; in fact it was more than sufficient. A trial upon that patent right took

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place lately, in the Court of King's Bench between twelve and thirteen years after the specification had been made, and then the question was asked, why we put all those things in; in fact, they were put in necessarily, to secure ourselves against this improper hardship of the law, but with no intention of concealment or confusion. That patent was one of the very few that have been established, but it was attacked upon every ground of objection that could be made to a patent.

What should you think of the appointment of a commission authorized to examine specifications, and to certify whether they were sufficient to enable the invention to be used by the public?—I think that a specification ought not to be inrolled at all, till it is made sufficient; and that there should be no further inquiry about the sufficiency of the description, except by way of appeal against the examiners; one-tenth of the trouble and expense that is now incurred, to find out whether it is sufficient or not, when it is too late to make any remedy, would have made it sure at first.

Do you think a commission would be a proper mode of determining that sufficiency?—I think a commission well constituted would determine that and many other points very well; but I think it would be very objectionable that any previous examination should take place, as to the merit of inventions; because it is impossible to foresee which will, by future cultivation, grow up to maturity, and which will not be worth such cultivation; hence every one should be allowed a fair chance.

Would you think that such a commission should consist of certain fixed members, or that it should be appointed *pro re nata*?—I have not considered that subject enough to make up my mind; but any competent person can say whether a specification is intelligible, or whether it is not; and if it is not sufficient, the inventor should be called upon to make it sufficient; if he proves that having used reasonable diligence he has not had time to do so, more time should be allowed than was at first granted. If he makes improvements afterwards, he should be called upon to inrol them, so as to keep the record of the Patent Office a correct transcript of his operations; that is the practice in France; but there it is left to the option of the patentee; I think it should be compulsory.

How would you propose to remedy the inconveniences you have stated?—I have not formed any specific plan; but knowing the practice of France, from having executed many specifications in that country, and seeing how much better their system is, I can speak from experience on the general principles that I have endeavoured to explain, without being prepared at this moment to say how far we ought to modify such a system in introducing it here; our circumstances are so different that it would require much consideration how it should be regulated.

You complained of the inconvenience of being hurried in bringing the invention to a specification, within the time given for it, how would you propose to remedy that?—By a discretionary extension of the time allowed for specifying; always granting three months, and more than that, when a fair case is made out.

At whose discretion would you place that?—In France, discretionary extensions of time are granted by ministers, at the recommendation of those referees who generally pass the specification, if it is judged expedient to keep them secret.

Upon a representation from the applicant?—I believe so; but the extension is not for the specification; they require a complete specification in the first instance, before granting the patent, in order to be transcribed in the patent itself. They also require the invention to be put in practice within two years; if the patentee fails in doing that, from reasonable causes, they allow him more time if he shows that he has used diligence, and has not succeeded for want of time. The specification is always given in at the first, and is copied into the patent itself, which is a great improvement upon our plan; I think the patent and the specification should always form one deed.

Would you compel the party to specify his invention as soon as he applies for his patent?—To specify the principles of his invention; more than that cannot be done in an efficient manner, until after it is put in practice.

How could the complete specification be inserted in the patent, if in applying for the patent he only gave in the principles of the invention?—He must have some certificate of having lodged the heads of his invention, or the outlines of the specification, that certificate being a sort of promissory note at sight, that he should have a patent given to him, upon his application, at any time within some certain period after date, the patent being given to him upon the condition of his then paying the price, and furnishing such a specification as should be approved, and which should, when made complete and approved, be inserted into the patent itself. Therefore the period which now elapses between his making the application and the inrolment of

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his specification, which is four or six months, would be the period which he would be allowed to make his experiments, and his specification founded thereupon; and he should have a full security against surreptitious communications of his invention in the meantime. The security against infringements should not be given, until the real patent is granted, with its meaning fully defined in itself; any previous security against infringements would be only nominal, because profitable infringements cannot take place in a new invention in so short a period. Infringements began before the date of the patent should not be inquired into, and the uniform continuance of them afterwards, should be allowed on fair terms, to be settled by arbitration, without giving the patenee any prohibitory power.

It appears that the course of application is, first, a petition to the Secretary of State, then the issue of the patent, and then the inrolling of the specification?—Yes.

The interval between the petition and the issue of the patent is uncertain?—It is; from six weeks to six months; commonly two months at an average.

The time between the issue of the patent and the enrolment of the specification is determined by the patent itself?—It is from two to eighteen months, as declared in the patent itself; commonly six months.

Then you would propose to secure to the applicant, from the time of his application, his right to the principle of his invention?—Yes, to the invention of which he details the heads; and all such fair developement of those heads as he is prepared to specify completely how to practise them, at the time when his specification is due, or with such extension of that time as is reasonable.

So that before his patent is issued, he should be required to enrol his specification?—Yes, in order that the specification may be transcribed in the patent itself, having been first approved to be sufficient, and if found deficient, or not confined within the limits of the heads first lodged, it should be amended. Whether the specification should be approved by a distinct commission, or by referees, I am not prepared to say; either way would do, if competent persons. The organization of a complete plan would require long consideration, but I feel very confident in the goodness of the principles I have suggested, having frequently considered them, but I have not set about the arrangement of any plan for carrying them into execution, because I never seen any chance of a new plan being adopted.

By a record of the heads of an invention, could you so secure to the applicant his invention, as to leave him at sufficient liberty to pursue his invention, for the purpose of making a complete specification?—I think he ought to be bound to be able to define his principle very accurately at his first application, because he ought not to be allowed even to apply for a patent, when his invention is a mere vision; he ought not to come until he has done all that can be done mentally, by himself, and by projection on paper, so as to be fully prepared to state all the principles or heads of his invention, leaving nothing remaining to be done but what requires to be decided by experiment.

In the experiments which it would be necessary to make, in order to perfect the specification, would he not run great risk of divulging his invention, although he had entered the principal heads?—I have not sufficiently considered whether those heads should be kept secret or made public. Some public notice of the application should certainly be given; but one object of my proposition is, that if an accidental disclosure of the whole secret did take place, the inventor ought not to suffer any material injury from it. I have been told that in France an applicant may give the heads of the invention in a sealed packet, and obtain security from that date; but I am not aware of the fact, from my own practice, nor do I find it provided for in the French law.

Will you instance, in the case of Mr. Watt's improvement in the steam engine, the proposals which you suggest for the improvement of the process in obtaining a patent?—I think that the deed which Mr. Watt enrolled for his specification, ought to have been lodged at the time of making the first application for his patent; and he should have been allowed at least two years for making engines and the experiments necessary for specifying the means by which those principles should be carried into execution; within that two years he should have made such a specification as would have really instructed competent workmen how to practise the invention, whereas that knowledge never came before the public from Mr. Watt, till long after his patent was dated, and then only incidentally, not by the operation of the law.

Could Mr. Watt have made that statement of heads of invention, without previous experiments?—Yes, at the time he drew up those heads (which I say are not specific enough to be a specification,) he really had made no engine, and only a private experiment by himself, with a very incomplete model, not a working model.

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Would a specification of those heads have secured him against any rivalry?—They did so in fact most completely for thirty years; his paper was most admirably well drawn, and very definite; but in allowing those heads to pass for a complete specification, a latitude was given to Mr. Watt, in favour of his great services, which the courts have never allowed in any other case, because they took it for granted, on very insufficient evidence, that they were sufficient directions to enable other persons to practise the inventions; but they are not so in fact, and upon the grounds on which courts have proceeded in all other cases, they should have annulled that patent, for want of sufficient description in the specification. It was sufficiently full and definite to enable him to maintain his patent; but those who wanted to practice the invention could not do it upon that specification. It told them plain enough what they were forbidden to do, during the term of his patent, but did not explain how they might do it, after the expiration of that term.

Then he gave in for a complete specification, that which, according to your ideas, ought to have been given in in the first instance?—Exactly so; and he never did give any complete specification such as I think ought to have been given in the second instance; the consequences of that omission have been important in his case, for long after the expiration of his patent, which was prolonged and kept in force in the whole for more than thirty years, engineers who wanted to make steam engines, had to go and steal a knowledge of his invention from his factory, or from examining engines made by him, with as much difficulty as if he had never had a patent. Going to the office and reading the specification did not answer the purpose at all. It was not till twenty years after the expiration of Mr. Watt's patent (which was fifty years after its commencement) that any number of the many manufacturers of steam engines in England, understood how to make them perform with the same perfection that they were made by Mr. Watt himself, within ten or twelve years after his patent, and as he ought to have instructed the public by a specification, as soon as he could have done so.

Can you illustrate by instances from patents that have expired, the two sorts of specification that you recommend?—Yes, I will draw up papers for the Committee for that purpose. The real specification in any invention of importance will of course be very long, and require drawings; but the heads of invention must be very concise but definite.

Was Mr. Watt's right to his patent fully protected by the law during the time he held it?—It was in fact, but I think not according to what the courts have held in other instances; they allowed his specification to be sufficient, when, in other instances, they have not allowed more complete specifications to be sufficient; but his case did not pass without many arguments for and against; Mr. Holroyd was his counsel; the courts were occupied with it several times in 1795 and 1796; his law expenses were enormous, and would have been very serious to him, if he had lost the cause.

Do you consider that the term of fourteen years is sufficient in all cases?—By no means; I have stated before that fourteen years profitable exercise of any invention is sufficient; the question is, when that profitable exercise will begin, and how much previous loss and outlay is to be made up; in some instances it begins from the first; in many instances it does not take place at all during the term of fourteen years. In the case of Mr. Woolf's invention of working steam engines by high pressure steam acting expansively (either in one or in two cylinders,) there was no profitable exercise of that invention for at least ten years out of the fourteen, and there was so much loss incurred at the first, that the profit made during the last four years never repaid it.

Will you explain what means it is necessary to resort to, in order to obtain an extension of a patent in this country?—That is only done by a specific Act of Parliament, which is very difficult to obtain, and very expensive to solicit.

Are there many instances in which patents have been extended by that means?—Several; but they have never been extended, unless the inventor had the foresight to get them extended at an early period of the invention, when there was no opposition to them; Mr. Watt would have found it difficult to have obtained his extension at a late period, or without the influence of Mr. Boulton; but at the time when they applied to Parliament Mr. Watt had revealed only the heads of his invention, as they stand in what he called his specification, but the means of execution, although fully made out, remained in his own keeping; it was a strange oversight, that Parliament did not insist upon his making a real specification, when the extension was granted.

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Are you aware of any applications for extensions having been refused?—Yes, several; there was one recently withdrawn a few days ago; Crosley's for a gas meter; Bramah's, for his locks, was withdrawn in the same way; that was tantamount to a refusal, because the parties would not have withdrawn their bills, if there had been any prospect of success.

Would you wish a discretionary power to be vested in somebody for extending patents?—That would be a very difficult subject; those discretionary powers should be very carefully watched, or they would grow into very gross abuses very soon.

In France, it is lodged in the Chamber of Deputies, is it not?—I believe it is; the only proposition that occurs to me on the moment is, that if a proper and responsible commission should be appointed, their recommendation to Parliament (founded on due inquiry and on their report, with evidence) might be very much attended to, so as to facilitate the obtaining such Acts of extension.

You would not think it desirable to vest that power in any other hands than those of Parliament?—I think not; if it were vested in the Crown, it would soon grow into the same abuse that existed before the Statute of James the First.

Does not the law, as to the duration of patents, operate very unequally upon different patentees?—Excessively so, almost in the inverse ratio of the merit and importance of the invention. An important invention is only a source of expense and labour to the inventor during several years, till it is brought to bear very completely; and frequently the greater part of the time expires before it is brought to bear at all. It often happens that the profit arising from the first exercise of it, after it is brought to bear, will not repay the loss and expenses which have been occasioned in its first establishment.

Can you give any instance of this oppressive operation of the law?—Many; Mr. Woolf's is a striking instance; he carried on business to a loss for at least ten years of his patent, and though he made profit in the last four years, it did not pay the loss during the first period. The extension since given to that invention is so important, that the existence of deep mining in Cornwall at this moment depends upon it. The difference in cost between the quantity of coals consumed by the engines now in use (which are all on Mr. Woolf's system,) and by an equal force of engines, such as were in use before he went into Cornwall in 1813, would absorb the profit of all the deep mining that is now carried on in Cornwall. I think Mr. Woolf is more entitled to a public reward, for the services he has rendered, without any recompence, than any inventor who has ever been rewarded by Parliament. Mr. Crosley, whose bill is just withdrawn, is another case; and Mr. Eaton, who invented the self-acting mule to put up by power. The establishment, and consequent profitable exercise of many inventions when made complete, is often retarded and prevented by public prejudice, and ignorance of their true value; also by the opposition of work-people, and the fear that they may mutiny in establishments where new inventions are first practised. I could give many instances of such cases; Mr. Eaton's is a strong one; the few machines that he made, when I prepared his specification ten years ago, have continued in profitable use ever since, but no more can be got introduced. Also Mr. Morton, for whom I made a specification in 1818, for a new slip to draw up ships, in order to repair, instead of a dry dock.

Will you state to the Committee what is the mode of proceeding by a patentee when his patent is infringed?—He must wait till he gets unquestionable evidence of the fact of infringement, which is often a very great difficulty. It facilitates the obtaining evidence to apply to the Court of Chancery; but if he has got good evidence he had much better come to a court of common law at once, without going first to Chancery. If he wants to extract the truth from the party infringing, he may possibly learn something by bill and answer.

If he has got evidence of the infringement, would not his first course be to obtain an injunction?—That is generally done to obtain evidence; if he has got evidence of the fact, the best course is to proceed at law.

Is it not an object to obtain an injunction, with a view to have an account kept of the profits?—That is the advice of most lawyers, but I never knew any practical good in it; because I never saw any real damages awarded for by-gone infringements, or those committed before a patent right had been tried and decided by a court.

May not the patentee pursue one of two courses, he may proceed either by a bill of discovery, or he may apply for an injunction?—Yes; in fact the Chancellor will grant an injunction *ex parte*, leaving it to be maintained, or removed, according to the answer of the defendant. If the answer alleges that the patent is not good, the Chancellor directs an issue at common law to try that fact, and in the meantime either removes the injunction, (leaving the parties to keep an account of the

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practice they make of the invention while the right is being tried ;) or if it is a gross case, he sometimes continues the injunction. After obtaining a verdict that the patent is good, the Chancellor would award the damages ; but it is so rare that a patent survives a trial, that I cannot tell you of any cases of satisfying damages being really paid by decree of Chancery. There is one now (the same Mr. Crosley before mentioned) who has got his patent safe through the Court of King's Bench ; it is Clegg's patent for gas apparatus, which I have before mentioned, and he expects to get a great deal of damages for by-gone infringement ; but I doubt very much of his success, upon the ground that the condemned infringers will say it was unknown whether this patent was good or not ; and therefore until that was known, they could not tell whether they might infringe it or not ; hence I expect nothing but nominal damages will be given.

What is the course of defence usually made by the infringer of a patent ?—The usual course (if unquestionable evidence is given of the infringement) is to contend that the patent is bad in law.

Have you known such defences frequently prevail ?—They almost always prevail ; it is exceedingly difficult to maintain a patent, the grounds upon which a patent may be vitiated are so numerous.

Supposing an incorrect specification has been made, what remedy have the public besides that of using the invention ; have they any means of setting the patent aside ?—A *scire facias* may be brought against a patentee, calling him into court to show why his patent should not be repealed, upon any ground of objection ; but it is a very expensive mode of proceeding, and it puts the parties opposed to the patent in the situation of plaintiffs, which is not often the best for them, and therefore they rarely resort to it. In the other case, several different defendants may attack him in concert, by infringing the patent in every quarter, and making a common purse to carry on the war ; that is a much better course for them, because if the patentee succeeds in one action, he must then try another and another, till his money is all gone, and he can scarcely ever keep his patent right alive to overcome them all. The few patents that have been supported have been commonly sustained by collusion with the infringers themselves, after one trial has decided that the patent is not absolutely bad, they combine with the patentee to allow them free use of the patent on moderate terms, and then, by making a common purse, they prosecute and suppress all new infringements : to effect that, they must keep up the appearance of law proceedings, but defend themselves so as to let the patentee get a verdict, which is only sham ; but added to the common purse, it serves to terrify new infringers, who are not allowed to have licenses or practice at all, whereby the patent right becomes a close monopoly, instead of a general practice paying a small rent to the patentee. If patent rights were made more secure in law, and by less expensive proceedings, it would not suit the interests of patentees to enter into such combinations, but, on the contrary, to promote the most extensive and open use of their inventions, under licenses, at a moderate tax.

When an incorrect specification is made, the remedy of the public, is, to use the invention and leave the patentee to his remedy at law ?—Yes, and the remedy is the same when the patent is bad on any other ground.

Is not the remedy of getting a bad patent set aside by *scire facias*, a very expensive one ?—It is.

Do you consider a more easy mode of setting aside defective patents should be adopted ?—I think they need nothing more than to let them die a natural death, which they do without any process at all. There is a long process laid down in some old law books, by which the patentee may be called upon to surrender and bring his invalid patent into court, to have it cancelled, and to have the great seal torn from it ; but all that is quite useless, and is never practised.

Do you think it would be right to allow patents to be supported for inventions which have become obsolete ?—At present if an invention has ever been known or in use in that part of the kingdom to which the patent extends, previous to the date of the patent, slight proof of that fact will set aside the patent ; the efficient revival of neglected and obsolete inventions I think ought to be encouraged as if they were new, but that would require regulation.

Can you set aside a patent on the ground that the inventor has not put his invention in practice, during the continuance of the patent ?—That is the law in France, within two years, but in this country it is only inquired into by the Judges as a measure of the merit and utility of the invention ; collaterally it operates, but not directly ; they assume that if an invention does not come into use, there is something wrong in it, and call upon the parties to show why it is not in use. The law requires that

that the invention shall be publicly beneficial, and if it is not exercised, that is *prima facie* evidence that it is not publicly beneficial, and the parties are called upon to show the reasons why it was not exercised.

Is it not the law with regard to patents, that you cannot take advantage of the invention of a principle without describing how that principle is to be exercised?—It is. The patent contains a provision, that no other person shall counterfeit, imitate or resemble the invention; that is construed in the courts to mean, that they shall not take the same principle, and use other means of carrying it into effect. But if the new means used by infringers, are so superior, as to supersede the original altogether, then they are commonly allowed to be used; on the ground that they must necessarily be new inventions, and not the patent one, which from its non-success, must be defective.

So that if in a specification you describe one mode of carrying the principle into practice, that patent would not cover other modes, by which the same principle might be carried into effect?—It would, if those other modes do not produce any superior effect to the original mode; but if they are so very superior, as to supersede the original, they could not be stopped by the patent. That is the manner in which I have found the courts to proceed; but it may be easily imagined, in such matters the courts will be continually deceived in the facts; and as there is no declaratory law, all inferences from precedents of this nature are very deceptive, because we cannot know upon what facts (real or assumed) the court founded their decisions.

Does not this prohibition to take out a patent for a principle, lead to a great multiplication of counts in the specification of a patent?—It does; and it is a great trouble and difficulty in preparing a specification, because it is necessary to foresee all the varieties of modes of execution that may be given to the invention, or principle, which is the essence of the patent right. It is necessary, for the security of the inventor, to describe them all, to preclude other people using them, and that the inventor may have his choice of that way which future experience will decide to be the best.

Is not there another reason for multiplying those counts, namely, to blind the public, and not to let them know upon which of the practical methods it is, that the inventor really means to depend?—I think that is rarely the intention of inventors, because when they make their specifications, they cannot know which is the best, for want of experience. They are always accused of that intention in courts, and called upon to show the contrary, but it can very rarely be so, when the specification is prepared by a professional man, who can have no motive of concealment, and who would lose his reputation if the description proved deficient; if he is deceived by a cunning inventor, he must be a very incompetent person. In Arkwright's case it was proved in evidence that he had deluded or overruled the person he employed to draw his specification.

Would not the allowing the patent to cover the principle, provided there were one good method described of carrying the principle into effect, lead to a more precise and clear specification?—Decidedly it would; but if the patent were given for the principle exclusively, it would be pernicious to the public, that other inventors should not be permitted to work upon that principle by other methods of execution, so as to produce a better result.

You think that for a limited period, between the taking out the patent and the inrolling the specification, the right ought to cover the principle of the invention?—Unquestionably during that period, the inventor should have an entire right to all those principles of which the heads are detailed in the first paper that is lodged, and all possible applications of them, in order that the inventor may have his choice, which application he will pursue in practice, in order to specify them. Having specified, his right by patent must be contracted to what he has so specified, but leaving him full liberty to add supplements, and thereby keep his right always enlarged up to the fullest extent that he can maintain, by continuing his labours.

Supposing a man falls upon the discovery of an entirely new principle of science, such as the condensation of steam, and its application to mechanism, how would you propose to secure the advantage to the discoverer of that principle, without precluding the attempt at improvement by other persons?—I do not conceive that patents are or ought to be merely a recompense to the inventor for the merit he has displayed, in what he has done previous to the grant being made; it is a sort of bargain, or a lease granted of some small portion of the public employment that is new, and has not hitherto been cultivated; that if the lessee will go to work to bring the new invention to bear, he shall have the benefit of working it for some certain time, which it is supposed will leave him a fair term, after it is brought into profitable

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exercise; but if the time, when properly employed, does not allow that fair term of profitable exercise, then some extension or recompense should be allowed, to cover the deficiency.

Supposing a person had discovered the principle of the condensation of steam, as applicable to first movers, and had merely given, as the mode of carrying that into effect, the form of the atmospheric engine; do you think that his patent ought to have precluded Mr. Watt, during the continuance of fourteen years, from applying for a patent for his steam-engine?—Certainly not; but at the same time it is very unjust to an inventor, that because he is superseded by some successor, he should lose all benefit from his patent; they ought to be allowed to go on together, and the profit ought to be fairly divided between them according to their previous labours, and expenses not yet recompensed, and the share each one has had in obtaining the improved result; neither ought to be stopped, the public ought to be served in all cases, and a recompense ought to be found for all those that have served the public. Such cases are not likely to occur frequently in great inventions, unless very long patent rights were established; a term even of twenty years is barely sufficient to establish one such invention, much more to see it superseded by another.

Supposing a person has discovered a principle, without inventing any method of carrying it into effect, and subsequently some method of using that principle is invented by another person; do you conceive that the person who has invented the method, should make some compensation to the person that has discovered the principle?—I think that he who has invented the method should be made to divide the advantage fairly with him who had before discovered the principle, because both parties have contributed to the public benefit; they are in the relative situation of a landholder, and the farmer who cultivates his estate,—both should participate.

How could you arrange the compensation?—It could only be arranged by arbitration.

In France, are not secret patents taken out?—In France, the specifications are always kept secret, during the term of the patent, and even afterwards, when the government decide that it is advisable to do so. The specification has sometimes been kept secret in this country, by express Act of Parliament.

Do you know any instance of a secret patent being granted in England?—Some specifications have been kept secret by specific Acts of Parliament. In the interval between granting the patent and inrolling the specification, application is made to Parliament to suspend the operation of that clause in the patent, whereby the specification is to be inrolled in the court of Chancery, and to order that the said specification shall not be made public; Commissioners are appointed by the Act to take charge of the secret specification, to examine its sufficiency, and to answer all legal questions concerning it, without disclosing the secret.

Do you know upon what grounds the specification is kept secret?—It is commonly upon the ground that the invention shall not get away to foreigners.

What is your opinion of the policy of such a provision?—I think it is always improper, that there should be any thing like a secret specification, under any circumstances whatever.

May it not operate unjustly against individuals, who, without knowing any thing of it, may be expending large sums of money in endeavouring to carry the same thing into effect?—Decidedly so; and as a means of keeping our inventions from foreigners, it is the highest premium that can be offered to an inventor, to go or send it abroad himself, because he will have no competition in the foreign country, and can obtain a patent there; it also offers a high premium to all the workmen to go abroad, who first get a knowledge of the invention (and who in that character, are for a time very important to both nations which shall get their services), whereas if foreigners can get intelligibly written specifications from the offices, for a small sum of money, they prefer setting their own men to work on such instructions, to the expense of taking our workmen away; or they do not begin at first, to seduce our workmen; and after a time when they do begin, we have got several instructed, so that the loss of a few is not felt. I know practically, the evils which have been experienced from useful workmen being enticed abroad, in order, by their means, to steal secret inventions, of which they possessed an exclusive knowledge: the best remedy for it, was to take out a patent in France, and I was sent there to solicit the patent, and thus prevent their exercising the invention there, after they had stolen it. That French patent has one of the most complete specifications I ever made; it is in the French language, and is now deposited in Paris; but no specification of the same

same invention exists in England, or in English. After that French patent was so obtained, a very considerable manufactory was established under it there by Englishmen; but the origin of the measure was to prevent seduction of workmen, which would never have happened, (or at a later period when it would have been of no consequence,) if foreigners could have got a specification freely from our patent offices, they would have set their own men to work on it by preference.

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Does not the claim of originality, with respect to a single minor point which is not original, vitiate the whole patent?—It does.

Do you not think that that is very impolitic?—It is a most excessive hardship and injustice, and every way impolitic; the reason for it is, that so long as patents are granted merely upon the request of the inventors, and whilst they are left at liberty to specify what they please, if there were not some limiting penalty of that sort, they would put inventions *ad infinitum* into their specifications, for the chance, that if one hook did not catch, another might.

Do not you think that the proper course would be to set aside that part which is not original?—Decidedly, that is justice; and yet it should not be allowed to the inventors to put an unlimited number of inventions into their specifications; but the practice of leaving them to their own discretion, under the penalty of setting aside their whole patent, because they have exceeded just bounds (which bounds are not defined) is both unjust and impolitic.

What do you think of the law which allows you to take out a patent for an invention communicated to you by a foreigner, and not allowing you to take out a patent for an invention communicated to you by a British subject?—I am not aware of any advantage in it, except as the contrary might tend to be a premium to the fraudulent obtaining of inventions. If the invention were fairly assigned, there is no reason whatever why a patent should not be taken out by the assignee, and in many cases with great advantage; because it so constantly happens, that the inventor is not so well qualified to pursue his invention into actual practice, as some other person, who for that very reason would become the purchaser, if encouraged by law.

If it can be proved that fraudulent possession has been obtained of the invention, it should be restored to its owner, or full compensation made?—Certainly; there can be no objection to patents to assignees of inventors; it would be a very great advantage indeed to make such a law; there was a bill before the House, some years ago, which I think contained that as one part of the provisions.

May not the present law operate with great injustice to the widow and children of an inventor, who dies before his patent is taken out?—The executor or administrator can take out a patent in that case; that is the reason in the case I have before mentioned, why eighteen months was granted; that is not by law but by custom. If a patentee dies before he signs and acknowledges his specification, the patent is lost, but the executors may take a new one, provided the secret has not got abroad, and they pay all the fees over again. The useless ceremony of appearing before a master to acknowledge, is sometimes a hardship in such cases. My brother took a patent, and fell ill by a paralytic stroke, before the specification was due, but the draft had been made out, and in very good time he signed the deed in bed; but after that it was very nearly lost, because he could not get out to acknowledge, as he had expected to be able to do; and if the master had not come to his bed-room at the very last, the patent would have been lost.

Since a patent for the three kingdoms, with the attorney's bill, costs from four to five hundred pounds, does not that operate as a tax upon different inventions with great inequality?—The expense of the patents for the three kingdoms is decidedly too high, but I do not think that the expense of a patent for one kingdom is too high; I think that the present expense of a patent for England, would be about the proper expense for a patent for the whole of the British dominions. I mean, that in the absence of any other check to an unlimited multiplication of patents, they should not be granted too cheaply. At present, while patents are to be had merely for paying the fees, there must be some limitation applied by means of the expense, and I think the present expense for England is a limitation which is sufficient; but when to the expense of a patent for England, the expense of one for Scotland, and another for Ireland, is added, and also an additional variable expense depending upon the difficulty of the subject, the sum total is in my opinion too much for mere limitation, and becomes a tax upon particular inventors, who are commonly the most deserving of encouragement.

Does any method occur to you of having the cost of a patent made proportionate to the importance of the patent?—Possibly it might be desirable to make little or no expense in the first instance, but to apply an annual and increasing tax upon the

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continuance of the patent right. To make the annual tax scarcely any thing at first, but to make it afterwards such a progressive tax from year to year, as would at last induce inventors to abandon the right before the end of the term, which in that case should be longer than at present (say 21 years). If the inventions were not very good ones, the patents for them would be cut off by this course, sooner or later. On such a plan, government might always ease a deserving inventor, by remitting his tax, when he had not been properly rewarded. But this is only a first thought, which I have not pursued through all its consequences; it would require much regulation. The proceeds of such taxes might be accumulated as a fund, to reward meritorious inventors, whose patents, like Mr. Woolf's, have not produced them a proper recompense for the services they have rendered to the community; also to purchase valuable secrets, which patents cannot be expected to protect.

You stated, in certain cases, that a part of the expense of taking out a patent consists of payments to professional gentlemen, does that arise from any useless complexity in the law respecting specifications?—Yes, it does; to the complexity of the process of obtaining a patent; and the necessity of specifying completely in a given time, which is often too short. It applies very forcibly to the law proceedings upon patent rights, which does not permit amendments or improved specifications. In obtaining of patents, the costs that are occasioned by payments to the officers of the Crown are fixed and invariable, except in a few cases, the others, relating to the specifications are necessarily variable, and according to the nature of the subject. I think that the sum total to the patentee should be made invariable, or nearly so.

Mr. Mark Isambard Brunel, called in; and Examined.

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YOU are an engineer?—I am.

Will you have the goodness to state any views you may have with respect to patents, or the patent laws?—I know very little of the patent laws; I have had several patents myself; I think that patents are like lottery offices, where people run with great expectations, and enter any thing almost; and if they were very cheap, there would be still more obstacles in the way of good ones. I think the expense of patents should be pretty high in this country, or else if it is low you will have hundreds of patents more yearly, and you would obstruct very much the valuable pursuits.

Do you conceive that 500*l.* is not too much?—That is too dear; I think that the expense of three patents is too dear; there are very few that take them from that circumstance; they imagine that it is enough to have a patent for England, and they think it is of very little use to have a patent for Ireland.

Could you suggest any means by which this too great facility of granting patents might be remedied otherwise than by the expense?—It is very difficult; it would be a very desirable thing to give more time to improve the invention, and then to come with a complete specification.

Do any means occur to you of protecting the applicant for a patent during the interval after he has applied for a patent and before the patent is sealed?—What is called a caveat is one of the means of doing that, and it has some effect, because then notice is given if another person comes to solicit a patent, if it can be detected in the head of that patent, that it has a similar object with that for which another person has taken a patent who has already entered a caveat. The caveat might be a little more extensive than it is, because if you change the name of the thing, it escapes the observation of the officers, and the two patents both go on; but if they are alike, there is a stop directly of the second. They are called before the Attorney General, who hears both sides, and he says to the second, you are like the other, and therefore first come first served.

Have you considered whether it would be advantageous to have a commission of persons appointed to examine the specifications?—I think it would be a very good thing; I should imagine that it would be an object for that commission to receive a rough outline of the invention, and to give the inventor a year or two to improve his machine, and then he may come again to the commission, and deliver a specification with all the improvements he has made during that time: that, I think, would be desirable.

Do you agree with the last witness in recommending that the patents should not be issued before the specification is ready, but that the certification should be contained in the patent when it is issued?—I see no inconvenience in that.

Are there any particular points with respect to patents or patent laws upon which you could give the Committee any information?—Nothing occurs to me.

What

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What do you think of the present rule of law, that the patents cannot be given for an abstract principle?—I think that is wise, and that ought to remain as it is; it would be dangerous to grant a patent merely upon a principle.

Supposing a person to have discovered a valuable principle, should he not be entitled to some remuneration from those that carry it into effect?—Of course.

Supposing any person should discover a means of making that principle useful to the public, would it not be right that the person who discovered the principle should have some compensation?—Certainly.

But you think that the person is not entitled to any patent right for the discovery of a principle, unless he has discovered some mode of carrying it into effect?—No, as a principle it is of no use whatever; it may remain ages, as steam has remained ages unused.

Are you aware of any valuable inventions for which patents have been granted, that have been lost upon some technical point?—I cannot specify any one in particular, but it is generally known that there are such cases, and a great hardship it is, when, for a trifling flaw, a patent is set aside; I have had to support my own right in one instance; I took out a patent for an improvement, and I specified the thing altogether; I could not maintain my action, because I was told I ought to have specified and defined what preceded, and what was my improvement; now, every body could know what existed before, and they might have used it, but it was very hard for me to lose the patent because that was not exactly specified according to the law.

Have you considered any remedy for that inconvenience?—There would be no inconvenience whatever in allowing the patent to stand good, because any one might take the preceding part, without infringing the patent.

You are aware, that if a person specifies any thing old in patents he loses his patent; do you see any objection to that?—There is a great hardship in that; if it is a thing which does in fact set his patent aside, then of course it ought to fall; but if it is a trifling thing, he ought to have the benefit of the remainder. It is a thing which nobody can guard against, because no inventor can know the thousands of patents that have preceded.

When a patent has been infringed, what remedy has the patentee?—An injunction against the supposed infringer; but if he closes his doors, you have great difficulty to get a knowledge of what he has done: the person says, My invention is not like your's, and I will not show it, because there are important things in it.

Upon the whole, do you think the patent laws are beneficial to the public?—Very much so.

What is your opinion as to the period of fourteen years?—It is a great deal for some, and not enough for some others; I shall lose probably six years before I come to make anything of my present patent.

Are you aware of the practice in France, with respect to the period of time that is granted?—Yes; that is better.

Can you suggest any better plan than that?—Perhaps there might be better plans for this country.

Do you think it would be desirable to allow a longer time for maturing the invention, before putting in the specification?—I think it would; if a longer time was allowed for an invention to be matured, the fee might be increased without any bad consequence.

Would you increase the time beyond fourteen years?—I think that might be done, in some cases.

In whom would you leave the discretion of giving a longer period?—That is a difficulty which I am not capable of removing.

Should the longer period be given by way of extension of the old period, or as an original period?—I think it ought to be an extension of the patent.

Would you think it desirable that a man might take out a patent for a shorter period than fourteen years?—Yes.

In that case do you think he ought to pay a smaller fee?—Yes.

The establishment of a commission has been mentioned as one of the propositions for the regulation of patents; do not you conceive that there would be much objection to a commission of that description, arising from the jealousies that would subsist?—Very great; if the invention could be laid before them, without knowing from whom it comes, it would be very desirable.

Do you think that in most cases parties could be brought to agree in the appointment of referees?—It would then be partial; because each party would of course name as many of his friends as he could.

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Do not you conceive that the Secretary of State might appoint *pro re nata* commissions of proper persons that would be satisfactory, upon the whole, to the public?—I have not thought enough of that; it is a serious question to answer.

What is your opinion as to the present mode of trying the validity of a patent by a jury?—I have frequently said, that I might as well toss for the fate of a patent; it is an intricate question for a jury, and in many cases it is quite unintelligible to them.

In such cases would not the appointment of a tribunal composed of scientific men, be very desirable?—Certainly it would be a very good thing; for example, one might say that the Royal Society would be a proper tribunal.

Do you conceive that the chance of having a patent fairly tried is greater with a special jury than with a common jury?—I think it is better; but if it is to be decided by a jury, it would be much better that it should be by some persons in the profession; at any rate it should be by competent persons.

Is not the number of such competent persons so limited, that the choosing them would almost amount to appointing a commission?—Certainly, that might be so.

Do you conceive that many persons are deterred from taking out patents by the insecurity of the present law?—I think it is a great discouragement.

Do you think that more people will depend upon secrecy than upon patents?—Probably so.

And in that case many good inventions are probably lost to the public?—Yes.

What are the prices of patents in France?—I think it is 1,500 francs for fourteen years.

Do you consider that too low a price?—For France it is very well, but for this country it would be too low.

What would be your opinion of giving a power to the Secretary of State or some other authority, to direct the specification to be concealed in certain cases?—I do not know what is the motive for concealing it; if it is on behalf of the inventor, that is some reason, but if it is to prevent its going abroad it is of no use, because if it is good it will soon make its way, and if it is not it is of no consequence.

Is not that the mode adopted in France?—It is; but it is not that liberal principle which exists in this country.

Is any inconvenience found to result from it in France?—I am not aware.

May it not operate with great injustice upon individuals who, not knowing of the patent on account of its secrecy, may be expending sums of money in accomplishing the same thing?—That is a great inconvenience.

Could you communicate it sufficiently to the public to enable them to avoid pirating the invention, without at the same time enabling them to make it?—Certainly not; because if a man gets two or three things, he will find out the remainder.

What do you think of the policy of allowing a patent to be taken out for an invention communicated by a foreigner, and excluding a person from taking out a patent for an invention communicated to him by a British subject?—I think it would be better if it were the same in both cases.

Is there any inconvenience in the present law which limits the number of persons interested in a patent to the number of five?—That is a commercial question, to which I cannot give any opinion; I think it would be mischievous to extend it without a limitation.

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Arthur Aikin, Esquire, called in; and Examined.

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IT has been stated to the Committee that between the first application for a patent and the obtaining the sealing of that patent, a period of six weeks or two months elapses; do you conceive that much inconvenience arises from that delay in obtaining the security which the patent gives to the inventor?—No, I do not think it does; there ought to be a reasonable security that the invention of the patentee should not be liable to be pirated in the intermediate time; but that being secured, any other delay that is reasonable I do not see the slightest objection to at all.

During that time you are aware that the inventor has no security for his invention?—I conceive that when an inventor makes an application for a patent, it should be

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be construed as a willingness on his part to give to the public useful information upon certain conditions ; and therefore, that there is an implied obligation on both parts, an obligation on the part of the person soliciting the patent, that he will make a full discovery of his invention ; and on the other hand an obligation on the part of the public, that while the patentee is taking the steps necessary to fulfil his part of the obligation, he should not be liable to be fraudently anticipated.

Would you not think it an improvement in the law, if any means could be devised by which the inventor should be secured from the moment of his making application for the patent?—Certainly I do.

Has any means occurred to you by which that might be accomplished?—I have often talked upon the subject with gentlemen concerned in patents, and I think the safest way would be to put the whole, from the first application for a patent, to its being granted, into the hands of examiners, or by whatever other name they might be called ; that is, of persons sworn to secrecy, to examine the petition of the person applying for a patent,

Do you mean that those examiners should have a power to refuse a patent if the invention is not thought worthy of having one?—The power of granting or refusing or of sending back for correction should depend upon the result of an inquiry made by the examiners. If they find that no patent has been granted for the object set forth in the petition, then I conceive that the inventor has an equitable right to his patent.

Then you would not leave it as it is now, upon the responsibility of the patentee himself?—Not entirely. The petitioner must necessarily run the hazard of his patent being set aside in case he has included in it any process already practised ; for it cannot be expected that the Attorney General or the examiners should be acquainted with all manufacturing processes or combinations of machinery ; but the petitioner, I think, has a right to require that the Attorney General by himself or by others, should examine all patented processes to see that his process does not intrench upon any of them, because if it does you are taking his money apparently for nothing.

Do you think there would be much difficulty in finding persons properly qualified for such an office?—I think not, because the only office to be imposed upon them would be, a comparison of the statement in the petition with the inrolled specifications. It would however be necessary to have an analytical index made of the contents of the inrolled specifications in consequence of the want of conformity between the titles of patents and the things put into the specifications.

Then until that inquiry had terminated, you would not have the patent sealed?—Certainly not. The following is a short statement of the proceedings, that I think ought to be had in taking out a patent, due regard being had on one hand to the interest of the public, and on the other hand to that of the patentee. It should commence by a petition addressed to the Attorney General, stating that the petitioner has made an invention likely to be of public utility, (the general nature of the invention should be here rehearsed) and that he wishes to have a patent for such invention ; also, that he be allowed time previous to specifying, to make experiments or to set up an apparatus on a working scale, and that while such experiments are going on no one shall be allowed to anticipate him by taking out a patent for the same. This petition should be put by the Attorney General into the hands of examiners, in order to ascertain whether the petitioner's invention has already formed the subject of a patent. If it has not, the prayer of the petitioner shall be granted, and he shall be allowed from three to nine, or perhaps twelve months, for making his experiments ; subject, however, to an obligation either of specifying at the end of that time or of forfeiting a certain sum. The petitioner having made his experiments, shall then proceed to specify by delivering in to the examiners a full account of his process with the necessary drawings, declaring that the above is a full and true statement. The examiners shall then call on the petitioner to perform his process before them, comparing the process with the written description of it, and requiring the petitioner to correct his description where defective or erroneous. Such corrected statement shall be certified by the examiners, and shall be handed over to a law officer to put it into the form of a legal specification. Such specification shall then be compared by the examiners with their certified description, and if found correct, shall be inrolled. The specification shall remain sealed till the end of the monopoly granted by the patent, and shall not be opened except by an order of court, in case the validity of the patent comes to be contested. But the patent shall not be set aside for any error in the legal form or error in dates, or

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clerical mistakes. If the patentee during the first seven years of his term practises any variation from the process or apparatus described in his specification he shall be bound previously to lodge with the examiners, a description of such variation, on pain of the patent being void. These variations shall form part of the patent, and the monopoly of them shall cease with the patent. But the patentee shall be allowed, during the last seven years of his term, to work his patent with any improvements, without being obliged to communicate them to the examiners. It is, I think, quite essential, both to the security of the patentee and to the eventual benefit of the public after the expiry of the patent, that the experiments which must necessarily, in the first instance, be made upon a small scale for fear of the inventor being fraudulently anticipated in his patent, should afterwards be repeated upon a large scale previous to the patent being granted. There is also another reason why this should take place, namely, that patents are occasionally taken out on speculation, not for the purpose of working them; but merely in order to obstruct the course of improvement in any particular branch of manufacture, and thus to enable the patentee to levy a tax on the real improvers, as being the holder of a patent not only not intended to be worked, but often not capable of being worked to any advantage in the manner set forth in the specification. With regard to fees, I should be inclined to levy a small one on the petition, reserving the principal payment for the enrolment of the specification.

When would you have the fee paid?—On the petition being given in to the Attorney General; and at the same time an obligation should be entered into by the patentee, either to go on with his patent, or else to forfeit a certain sum.

Would it not be better that the first fee should be so considerable as to amount to an obligation?—I think not; I should be rather for the plan of deposit, and allowing that deposit to go towards the fees on the specification. In the first instance, I think all you have a right to demand is a fair fee for the trouble given, and an obligation that the patent shall be gone on with, under penalty of a certain forfeiture.

Suppose a man paid a fee of 10*l.* and gave an obligation for a bond to the amount of 20*l.* would it not be the same thing as if he at once paid a fee of 30*l.*?—I think not, because if a man has made his experiments upon a large scale, and they are found to answer, it would then be worth while for monied men to join him, and to enable the petitioner to pay the fee. Many inventions are made by persons by whom a large fee could not be afforded, and a monied man would be more disposed to advance the necessary funds, after it had been ascertained by an experiment performed upon a large scale, that the invention was likely to answer in practice; and even if in the first instance the petitioner had made a conditional agreement with a monied man, still that monied man would be more likely to close with him, if the sum to be paid, although certain to be paid sooner or later, was only to be paid after those experiments were made.

In either case, if he does not proceed with the patent, or if he does proceed with it, according to that principle he must still have to pay the sum for which he had entered into an obligation?—Yes, but I think instead of levying it in the first instance in the form of a large fee, it would be better to take it in the first instance as a small fee and an obligation.

You are aware that the heavier part of the fees is not paid till the patent is sealed?—Certainly; it is in conformity with the present practice that I would reserve the heavier fees to the latter part of the business, either the enrolment of the specification or to the sealing the patent, which I think ought to be the last act.

How would you regulate the time to be allowed between the petition for the patent and the enrolment of it?—It should depend upon the nature of the invention, and the Attorney General must be the judge of that; it might vary from two months or three months to six or nine months in case of particular difficulties.

Who would you make the judge of the length of time to be allowed?—I think the Attorney General should be the judge.

You think that a person applying for a patent should be secured of obtaining the patent from the moment of his application?—I think he should; all that the public have to require from him is perfect honesty in giving in his specification, and that his invention has not been anticipated by any previous patent.

Afterwards you would require from the Attorney General that he should examine the specification?—Yes, either by himself or by examiners; it would be better to do it by examiners.

By

By whom would you have those examiners appointed?—By the Attorney General.

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You talked of a sealed specification, do you mean that the specification should not be open to the public?—I think it ought to be open only in case of requisition from a court of justice; I do not think it should be open for general inspection till the end of the term.

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Is not that the case in France?—It is, I understand, a good deal the case in France.

In that case, what security would the public have that they should not be prosecuting inventions for which a patent has already been obtained?—It would, I think, be very difficult in such case to conciliate the security of the public and of the patentee.

Have you not stated, that on the first application for a patent, the inventor should go before the Attorney General with a petition, before he had made any experiments of any extent?—Yes.

If so, could any one wishing to become a patentee, after another had obtained a patent which was sealed up, be misled beyond the moment of his petition to the Attorney General?—No person wishing to take out a patent could be misled, but a person might make an invention which had been anticipated, and which would be found to be contained in a sealed patent, and a person might erect apparatus for the purpose of carrying it on, and then be liable to be told that it is guarded by a patent; I am aware that there would be that difficulty.

Must not that be the case in France and Holland?—I suppose so, but I do not know how they get over that difficulty.

How do you propose to obviate that difficulty?—I cannot tell; there are difficulties on both sides. On the one hand, I think there is a great deal of annoyance that the patentee is liable to from fraudulent attempts to come as near his patent as possible, without actually infringing it; and on the other hand, I am fully aware that there is also the objection which has been stated on the part of persons *bond fide* making improvements, and finding, after they have been at the expense of setting up apparatus, that they are prevented from using them by patents already taken out. These are two difficulties which oppose one another, and I do not see how it is possible to get completely clear of both of them.

Do you consider the greater objection to arise from publicity?—I think it does; as soon as ever a patent worth working is known to be public, every one concerned in the same kind of business, instead of making his arrangements with the patentee, rather begins, in the first place, to see how he can get the same advantage as the patentee, without paying anything for license; and this is generally done either by contesting the patent, or, which is not quite so fair a way of doing it, by calling some person in aid to point out how it can be safely infringed.

You first of all propose a petition to the Attorney General; having secured that, and the Attorney General being satisfied, you are then to go on with a train of experiments; are you prepared to say how the patentee is to be secured while he is upon those experiments; do you intend, that having so petitioned, he shall be perfectly secure in law against any thing that might turn up, that any other man had done in consequence of seeing those experiments tried?—Certainly.

Are you aware that at this moment, if any person having an intention to take out a patent goes to a person to try it for him, the person whom he employs in that manner would be prevented by law from having any power to use it for himself?—Yes.

Then the security that you would give would be in the petition rendering it impossible that afterwards any one should pirate it?—Yes.

At present, although it is supposed that the caveat is a security, in point of fact is not a caveat very little better than a public notice to others that you are going to do something which they had better look after themselves?—I do not think a caveat is any real security at all.

Supposing the law were altered in the manner you propose, so that instead of the patents being left open to be decided by a court of justice, they were to be decided by some secret tribunal in the nature of examiners, or a commission; do you think that would be equally satisfactory to the public with the present mode?—My plan only goes to regulate the manner of granting patents; my examiners are not a secret tribunal to decide on the validity of patents, but sworn commissioners to see that the patentee has made a full and true disclosure of his invention in his specification previous to his patent being granted.

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You are aware that a patent before it is granted goes through a variety of different offices?—Yes.

Are you aware that it has been stated in different courts of law, that this long course of proceeding is intended to make sure that a person does not take out a patent for an improper invention?—Yes.

Do you conceive that that object is effected by the present law?—I think not; because I do not know that there is such an examination into the nature of the invention in any part of that legal investigation as tends to give the public or the patentee that security to which they are respectively entitled.

Then are the Committee to understand that you consider the practice as differing entirely from the theory of the law in that respect?—I do not think that the legal investigation previous to a patent being granted, satisfies the claims either of the public or of the patentee.

Would not a commission such as you describe, inquiring into the merits of a patent, fulfil the original intention of the law?—I think it would; because I should propose that those examiners should merely inquire into the agreement of the statement that the candidate makes of his invention, with the experiments made in the large way, and personally witnessed or inspected by the examiners.

Can you give the Committee any information as to the manner of preparing specifications; are you aware that specifications are frequently, especially in chemical processes made imperfect with the view of concealing the process?—Yes, I am certain of it; and it was with the view of preventing the fraud which runs through the whole system of patenting, that I think examiners ought to be appointed to see that the actual produce of the manufacture agrees with the statement given in the specification.

Is it not often impossible in chemical results, to ascertain whether the specification is properly given or not without experiment?—Quite impossible.

Are those specifications not made purposely deceptive because the public get hold of the specification as soon as it is published?—There are two reasons, I apprehend, for concealment in the specification. In the first place a fraudulent patentee will be very glad to have protection for his invention without giving up the whole of his secret; and the great probability of an invention being pirated is also a motive with many to conceal part of their process, even without any direct fraudulent intention, but only in self defence.

If the specification was concealed, would not that desire be greatly removed?—Certainly it would.

Then you conceive the public would gain as much as the patentee would by a previous examination of the specification by persons properly qualified?—I think the public would; because if you examine those patents that have expired, many of them cannot be worked at all, because the patentees, either from negligence or from fraud, have omitted stating particulars which (although not obvious to a person reading over the specification) would be found to be of great importance in endeavouring to carry the invention into effect.

Have you not found that persons put things into patents that have nothing to do with the original title of the patent?—It is perpetually the case; there ought to be a much closer correspondence between the subject of the specification and the title of it.

If any material circumstance be left out of the specification, would not that invalidate the patent during any period of the fourteen years?—No doubt it would.

Supposing a commission or assessors should be appointed, what are the points to which you think their attention should be directed?—I would not have them responsible for any of the legal language of the specification, because it rarely happens that you can obtain in one person the necessary combination of legal and scientific knowledge. In order that the specification be secure, it is at present necessary that there should be a combination of both. Now the duty I would impose upon the examiners would be only that of seeing that the statement made by the patentee corresponds with the process, as brought into practice; I would then leave to other persons the obligation of putting it into legal form, and then I think in equity the patentee ought to be secured from any risk of his patent being overthrown upon a mere legal technical objection.

Then you would advise that the responsibility of the description being sufficient to enable the public to carry the invention into effect, should rest in future with the examiners, and not with the patentee himself as it does now?—Yes.

Have

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Have you at all considered how such a commission could be formed so as to be competent and satisfactory to the public?—I do not suppose there would be any great difficulty in finding persons properly qualified. The general run of patents may be considered as divided into mechanical and chemical patents, and I apprehend there would be no difficulty in getting persons perfectly competent on those subjects to examine the statement given in by the petitioner, and to compare it with the actual machine or process.

You think there could be no difficulty in finding many qualified persons?—None at all.

Do you conceive that it would be an easy thing to constitute a board of that description, which would be free from the jealousies naturally arising in the competition of ingenuity?—I think I have left no room for jealousy, because the only duty I should impose upon those examiners, would be an inquiry whether the written statement made by the patentee agrees with the result of that process as carried on on a large scale.

In case your commission adhered strictly to its duty, and confined itself to the point of fact, there could be no objection to it; but might they not be liable to suspicions of exceeding the powers committed to them?—I think not, because it would hardly allow of any difference of opinion. If any one was desired to compare the written statement of a process with a process as actually performed, there is hardly any room for a difference of opinion; you read over the description step by step, and see whether the process, as described, is actually carried on.

Are you aware that a great number of patents now are set aside in courts of law, on the ground that the description is not sufficient to enable the public to work the invention?—Yes.

Then such a plan as you have proposed would obviate one great source of litigation?—I think it would. There is another thing which I have observed with regard to patent causes, which induces me to recommend that the patentee should not be liable to be thrown aside by mere legal objections, which is this, that in trials on those occasions it not unfrequently happens that neither the jury nor counsel, nor even the judge, understand the subject. The natural tendency therefore in the minds of the judge and counsel is to decide the case before them on a point of law, that being a subject with which they are familiar, rather than on the practical parts of the specification. I have seen this happen so very frequently, that I think it is very desirable that it should be prevented if possible, because it is not doing justice to the patentee, or to any party at all.

Have you considered the propriety of the present rule of law, that a patent cannot be given for a principle?—Yes.

Do you conceive that that could be modified in any way?—I think decidedly that a patent should not be granted for a principle, unless accompanied by a specification of some practical application of it.

Supposing a new principle to be discovered and applied to practice in one efficient mode by the inventor, should he be entitled to a patent protecting the principle, however otherwise applied?—That I think would depend upon the nature and extent of the principle.

Take, for example, the principle of condensing steam in a separate vessel?—I should be inclined to allow Mr. Watt, the inventor, to have a monopoly of it, provided in his specification he had given (which he has not given) all the details of the machinery employed by him at the time of taking out his patent, whereby he carried the principle into practice.

Are you aware of any inconvenience that has arisen from the present rule, that more than five persons cannot be interested in the property of a patent?—No, I have no experience of that.

Does it not frequently occur that a principle though it is not directly applicable to any practical purpose, nevertheless may be made indirectly applicable and very beneficial to the public; for instance, suppose the common principle that the tension of a spring varies as its flexion (which is the foundation of the construction of all chronometers), suppose that principle to be discovered, do not you think that the discoverer of that principle would be fairly entitled to some payment in the shape of a toll or tax upon the construction of chronometers subsequently?—I think not, unless he had brought it into effect, unless he had shown a practical mode of doing it.

May it not frequently occur that an individual of great mathematical science may discover a principle and yet may not possess that mechanical skill which would

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bring it into practice, and he may therefore let the principle lie by for a great length of time; but if, on the other hand he were to be allowed to derive some compensation from the subsequent application of his principle by other persons, he would be induced to divulge it?—I should be inclined to restrict it rigorously to things actually brought into practice, as long as the principle is a bare mathematical or chemical principle, without any actual application of it I should not give a patent for it.

Take for example the principle of the conical pendulum, which you are aware performs revolutions in equal time, and which has been most extensively applied to the steam engine; do not you think that the discoverer of that principle would be entitled to some compensation from those that subsequently applied it, in the shape of the governor to steam engines?—I think not; I should require the inventor to have applied it practically before he took out a patent for it.

Have you considered whether it would be an advantage to allow parties to take out patents for short periods instead of fourteen years with a proportionate diminution of expense of fees?—I do not see that it would; because, generally speaking, it would not be agreeable to a patentee; for whenever a patent is taken out it requires some two or three or four years to bring it into actual operation, and if you have a patent only for seven years the time is expired before you get any thing from it.

Mr. Charles Few, called in; and Examined.

Mr.
Charles Few.

ARE you very conversant with the practice of taking out letters patent?—I have taken out several.

Do you agree in the opinion which was given by the last witness, as to the expediency of the Attorney General appointing assessors or commissioners to examine the matter of the petition, before he recommends it to be passed?—I entirely concur with him on the efficacy and the propriety of a commission instead of the present mode; because the practice before the Attorney General is little better than a farce at present; I would allow every person that chuses to take the risk and expense, apply for a patent and have that patent, in case no caveat is entered against him. In case of a caveat, I would have it come before the Attorney General or a barrister to be appointed, who should be the head of a commission, which might easily be formed of scientific and practical men. When Mr. Howard was obtaining his patent, we attended before the Attorney General, and Mr. Constant, who was soliciting a high pressure patent, I believe, we were heard before Sir Vicary Gibbs, and he stated that he was so satisfied that Mr. Howard's patent was the same in effect as Mr. Constant's, that he would not allow them to run on together, and therefore suspended ours; we had to wait till his specification was in (I believe six months), and when we saw his specification, it was as little like as need be, and we obtained our patent.

Mr. Aikin also stated, that he thought it would be desirable that a commission should be appointed to examine the specification, in order to ascertain whether it is a sufficient specification; do you concur with him in that?—Upon that point, I differ from him entirely; I think it ought to be at the risk of the party putting in his own specification; but I would leave the sufficiency of that specification to be decided not by the courts of law, but by a commission. If a patent was granted, and any person wished to set aside that patent, he should do it by a petition to the Great Seal; and that petition should be referred to a commission, who should decide it.

You would not have the validity of a patent tried by a jury?—Certainly not; for very frequently they can know nothing about what they so try.

Then you would confine the operations of the commission to cases in which the patent is in dispute?—Certainly; there are many objections occur to me at the moment to Mr. Aikin's plan; the commission ought to have the patented article brought before them perfect, not be themselves bound to be present at the operations; suppose it is an improvement in a diving bell, or an improvement in a ship's cable, or an improvement in some colliery, are the commissioners to go into the diving bell, or are they to witness the efficacy of the cable, or go down into the colliery; if I choose to risk my money in a patent, that is my look-out; I cannot agree with Mr. Aiken as to the expense of obtaining a patent being small; I think it should be a pretty heavy sum, and I would have the inventor protected from the moment he made his affidavit and petitioned for his patent, but I would make the first payment somewhat heavy, to show that he was in earnest; I would give him six months to deposit his specification, and I would also give to the same Commissioners,

sioners, in case that specification appeared defective, and they thought *bond fide* it was an error of his in making the omission the power of allowing him to amend the specification.

To whom would you have the inventor apply originally?—To the Attorney General or to the Secretary of State.

Would you abridge the period between the application for the patent and the sealing of it?—The period would not be very material, if the patent right was protected from the time of petitioning for the same; the fees payable at the Privy Seal Office and the other offices may be as well all paid at once.

Supposing the expense of taking out a patent to remain as it is, is it your opinion that it would be better that the party applying should at once pay that sum than that he should pay it through the variety of offices through which he now pays it?—Yes.

Would you increase the fee upon patents?—Yes; I would have it such a sum as would pay the commissioners; there is no reason why they should not be paid by the patentee; he ought to pay the expense of the commission by which he is protected; I think that the commissioners should be the ultimate judges; I would never have the validity of a patent tried by a jury; on a trial witnesses come and state, that they have read the specification, and that the thing can be carried into execution in the easiest manner; then, others on the opposite side, depose that it cannot be done; and the judge knows nothing about it more than the witnesses state, and the jury less; that is the way in which patent rights are tried; we are just on the eve of closing Mr. Howard's patent, and we are going to have three issues tried, which will cost a thousand pounds at least, perhaps twice that sum.

When you say you would rather increase than diminish the fees, do you allude to the separate fees for the three countries, or would you make one patent to stand good for all the three countries, putting one sum upon the whole?—I see no objection to that, except that the fees belong to the different Secretaries of State of England, of Ireland, and of Scotland, they must be provided for and apportioned somehow or other; one patent would be just as good if it extended to the three kingdoms; but my attention has not been before called to the subject.

From your experience, do you not believe that any patentee who is sincere about the sort of patent that he means to take out, would rather pay double the fees that he does at present, if he could be allowed to pay them all at once, and instantly secure his patent right, instead of being detained three months, during the whole of which time he is never safe?—I think the present delay is decidedly objectionable; it depends upon the illness of the Chancellor, or his absence from business, or the Attorney General's engagements; and I think a patent ought to be protected from the moment the person presents his petition.

Are you prepared to suggest any plan for the composition of such a commission?—I think it should be composed of chemical men, and men acquainted with mechanics, and a barrister.

Would the decision of such a tribunal give general satisfaction?—I am not sure that it would, but it would be a more sensible one than the present; and I am sure the present mode never can give satisfaction. I quite concur in the suggestion Mr. Aikin made as to protecting improvements after the patent is obtained, because at present if you deviate in consequence of subsequent improvements very considerably from your specification, a judge will be very apt to say you are not working yourself on the patent you have got, and hence infer that you are to be taken as admitting it does not answer the end intended. If those subsequent improvements, as they were *bond fide* made, were allowed to be appended to the specification, so as to run concurrently with the patent, it would be good for the public and good for the patentee.

Would you make it compulsory upon him?—No, I would make it permissive; and in doing that it should protect him. With regard to Mr. Aikin's proposal of keeping the specifications secret, I think there would be more mischief done by close specifications than by open specifications.

The Committee have been informed that cases occur not unfrequently in which for the first ten years of a patent very little profit is derived from the invention, but that during the last three or four years it begins to be very beneficial; in such cases as those would you recommend a power of extending the patent?—I would in all cases leave it to be extended for another seven years; at present we must go to Parliament to get it extended, which is very expensive.

Mr.
Charles Feu.

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Mr.
Charles Few.

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To whom would you give the power of extending it?—A commission of which I would have the Attorney General at the head.

It has been stated, that if a man has obtained a patent for an invention and not carried that invention into effect, it would be desirable to set that patent aside after three years of non user of the invention; do you consider that there would be any advantage in that?—I think it would be for the benefit of the public that it should be so.

You consider it inconvenient to the public that patents should be kept in suspense for inventions that are not used?—Certainly.

Are you satisfied in your own mind that great inconvenience would result from considerably reducing the expenses now necessary for taking out patents?—I am quite satisfied about it, even with the present expense there are so many trifling patents taken out. If the fee was much higher, parties that are now taking out patents for little speculative things that do not answer, would not take them out. They act something like the dog in the manger; they prevent the public from benefiting by the invention or improvements on it for fourteen years, and yet do not benefit themselves.

Do you think that one patent should extend to the three kingdoms?—I rather think it should.

Do you not believe that many persons conceal their inventions only because if they go for a patent they must give it in such a way to the public, as that others can instantly pirate them, and that men work in private in preference?—I think it is very likely, but I do not know it of my own knowledge.

Can you give the Committee any idea of the average expense of protecting a patent?—It is very uncertain; the patentee files a bill in Chancery for an injunction, on the hearing of which the Chancellor either retains the bill for a year, leaving the plaintiff at liberty to bring an action, or directs issues, in either event a trial at law is the consequence, the expense of which is very uncertain, but very great, and after the trial the party, if successful, has again to return to the Court of Chancery, and obtain a reference to one of the Masters to inquire into the profits made by the infringement, after which the cause comes on for further directions, and is finally disposed of.

Luncæ, 18^o die Maii, 1829.

Mr. Francis Abbott, called in; and Examined.

Mr.
Francis Abbott.

18 May,
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HAVE the goodness to state to the Committee the process of taking out a patent from the first application at the Secretary of State's office, or from the first putting in the petition, to the final sealing of it?—It is sometimes usual, although not necessary, to enter a caveat as the first step, which is considered a kind of precaution that a patent shall not be run against the applicant, as soon as it is known he is applying; for there are already caveats in, and immediately his reference comes to the Attorney General it is circulated about, and if any casualty happens to delay him, there have been instances where somebody else has got a patent on the same subject, while he has been, for some cause or other, delayed; but it is usual in many cases to enter a caveat previously to making an affidavit; when, after entering the caveat, or without entering the caveat, the first step is the affidavit made by the person, that he has either invented, or has had communicated to him by a foreigner, some discovery. Having made that affidavit upon it, a petition is presented to the King, praying a grant of Letters Patent for England, Wales, and Berwick-on-Tweed, or with the addition of the colonies; the colonies are frequently omitted because it is attended with some extra expense, and in many inventions it would be of no use to embrace the colonies; that petition being presented to the King, through the Secretary of State, a reference is made by the Secretary of State in the name of the King, to the Attorney or to the Solicitor General to report. I am confining my observations now to the application for an English patent, not for an Irish or a Scotch patent; the Attorney and Solicitor General on having the reference submitted to him, either makes a report in favour of the application, or it is stopped by caveats if there are any caveats; the clerk looks over the books, and finding any caveat for a patent on the same subject, the applicant is delayed a week from the time that notice is given for those who have received notices on their caveat to decide whether they will oppose or no, if within that week the person having

having had notice says he shall oppose; the next step is to take out a summons for the hearing before the Attorney or Solicitor General; a week's notice more is given of that appointed time, he at that appointed time hears the parties if they attend; but it is too frequently abused by the parties who have said they should oppose, not opposing, and sometimes a patent is delayed a fortnight or three weeks; sometimes the Attorney General cannot grant a patent; sometimes the Attorney and Solicitor General are so occupied with other concerns they cannot attend, and a man is frequently delayed a fortnight or three weeks by somebody saying he shall oppose, and when the time comes, just at the hour of appearing, saying he does not oppose, or he does not attend; and instances have arisen, where patentees have been brought some hundreds of miles to support their application, and when arrived no opposing party has appeared. In a very recent case I was applying for a patent; I was delayed near a month just in that way; the intimation was given, but the party did not withdraw his opposition until the time appointed for hearing, and then he came and said "I am not prepared," or "my party is not come," or something of that description. If the parties attend they are heard before the Attorney or Solicitor General, first the applicant and then the opponent; and then if he sees any reason to think there is an interference, he stops it; he exercises his own discretion on it, governed of course by what transpires on the examination of both the parties; if he thinks there is no interference between the applicant's and opponent's invention he makes his report in favour of the application; that report is taken back to the Secretary of State's office for what is called the King's Warrant; that warrant recites shortly that such a person has applied for a patent, and that the King is advised to grant it; and he, in general terms, directs the Attorney General to prepare a patent for the King's signature; the warrant, as it is called, is taken back then to what is called The Patent Bill Office; it is still under the Attorney and the Solicitor General, but not in their own private office; a separate office, which is exclusively appropriated to the engrossing of patent bills; it is taken back there, and in the course of a week, or sometimes more, the bill is prepared and signed by the Attorney General or Solicitor, and taken back for the King's signature to it, and it is then called The King's Bill: the King having signed, it goes to the Signet Office, where it passes, and then it is called "The Signet Bill;" from thence it goes to another office, when it undergoes the Privy Seal, then it is called "The Privy Seal Bill;" from the Privy Seal it goes direct to the Lord Chancellor's office and receives the Great Seal: originally it used to pass another stage, which is now dispensed with; it used to go to the Hanaper, to pay the Hanaper fees on it; it is not now taken to the Hanaper Office; but the Lord Chancellor's officer, the clerk of the patents at the Great Seal, receives the Hanaper fees and pays them over; so that it does not now go to the Hanaper Office, and then it receives the Great Seal, if there is no caveat; if there is a caveat, notice is given on it, and if the party says he opposes, then the applicant has no means of getting rid of that caveat but by a petition to the Lord Chancellor; those in modern times are very rare. When I first began to pass patents, they were much more frequent than at this time of day, because at that time they were vexatiously resorted to in many instances, it being considered that the Lord Chancellor had no power to award expenses, however improper the opposition; but about thirty years ago,—approaching to near thirty years, after mooting the question several times before the Lord Chancellor, on a petition I presented, at last expenses were ordered to be paid by the person who had either not sufficient grounds, or did not appear to support them; in that case the Lord Chancellor did order expenses, and since it has been found that the expenses can be, and are frequently awarded at the Great Seal, the oppositions there are much less frequent than they used to be. When the caveat is removed, or if there is no caveat, it passes the Great Seal, and then it is completed.

That is the whole process?—That is the whole process as regards the English patent.

Now as to the colonies?—It is only a little extra expense as to those, but it does not alter the system at all in any way; it is only an alteration in the prayer of the petition; instead of confining it to England, Wales, and Berwick-upon Tweed, the petition adds, "and all Your Majesty's colonies and plantations abroad;" in other respects, it is the same process to pass it through the different offices; it is attended with no extra trouble, nor is there any separate document; it is all included in the same, only with those additional words, and it is attended with an additional expense, perhaps six or seven pounds. I generally recommend it to be dispensed

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with, for I have never yet seen any utility, in very few instances at least have I seen utility, in extending the patent to the colonies.

The Committee have been informed, that when it is advisable to extend a patent to the colonies, if you include one of the colonies that has an independent legislature, it is necessary to obtain the consent of that legislature?—That has never occurred in my practice, and I was not aware of it; it is the first time I heard of such a practice.

Is the mode of taking out a patent for Ireland precisely the same?—Not exactly so: the first step is a similar affidavit and petition to the King; the prayer only praying it for Ireland, instead of England, Wales and Berwick-upon-Tweed; then it is referred to the Attorney and Solicitor General in Ireland, and it goes to the Lord Lieutenant, the Attorney and Solicitor General, I believe; and I think it goes to the Lord Lieutenant, who refers it to the Attorney and Solicitor General; they make a report, and it comes back here for what is called the King's letter, something similar to the King's warrant on the English patent; that letter goes back to Dublin; then the patent goes through several offices, the *minutiae* of which I cannot tell the Committee, without I had some documents to refer to.

Are all those formalities requisite for a person who has previously obtained a patent in England?—Certainly; and a similar process is adopted to obtain a Scotch patent. The Scotch patent passes a seal that is called a "Substitution for the Great Seal of Scotland," at Edinburgh; and the Irish patent passes the Great Seal at Dublin; the English one, the Great Seal here,—all three separate and distinct jurisdictions; the same expenses incurred; the Irish is rather more than the English, but you may average them all three at about coming pretty near; the Scotch and Irish, taken together, I average at about the amount of the English.

And what is the amount of the English?—There are so many circumstances that vary the amount, it is difficult to speak with any thing like precision; if I was to say upon an English patent with one name only, and not extending to the colonies, including the fee for passing it, I think it is about 110*l.*; the solicitor or agent, or whoever passes it, has always, since I have been meddling with patents, more than thirty years,—has always had a fee of ten guineas on passing it; including that, an English patent, with one name, and not referring to the colonies, taking it at a round sum, would be 110*l.*

That makes out the whole expense for the United Kingdom, 240*l.*?—If I am to understand England, Scotland and Ireland, I should say certainly 330*l.* for the three.

What length of time does it require, before the patent is sealed, for the three kingdoms?—I am to understand by that the three patents, instead of one patent?

Yes, the three?—The English patent depends so much upon casualties, that you cannot mention the time; they used to be certainly more expeditiously obtained than they are now—certainly considerably more expeditiously obtained than now; sometimes now they are three months or more getting a patent. I have got two going on now, where, unless I get them to-day from the Secretary of State's, they have remained, I think, nearly a month waiting the King's signature to the warrant.

So that in England, a patent may be three months?—Under some circumstances it has been certainly got often considerably below that period, a month or five weeks have been sufficient to get a patent in; but it is rarely, in modern times, you get it in twice that time.

And for an Irish patent, how long?—There it is longer; how to account for it I do not know, but you can seldom get an Irish patent in less than five or six months; it is the more unaccountable, by reason that the royal signature is only required once for an Irish patent, they have it twice for an English patent, and it is only required once for a Scotch patent, and I cannot account for the great delay; and I have often, and every body who has had anything to do with it have felt the great inconvenience they are put to in getting a patent for Ireland, so much so, that I have often remonstrated, and had to press it on; I have frequently said, the patent is in danger of having the Irish patentee's right destroyed, inasmuch as he must specify in England, and anybody may see that specification here on paying the office fees for search, and by sending over to Ireland the whole subject-matter of it, there is no patent right to prevent it being used there, and being used is completely destructive of the patent, if the patent has before that time passed the Great Seal.

Cannot

Cannot he enter a caveat in Ireland?—That is only preventative of any other person taking out a patent right; it does not prevent a person using the thing if he can find what it is, it only prevents him getting a patent for it. I have often had occasion to remonstrate from the danger that was likely to arise from that delay, and I have pressed it in every way I could, but I could never get a patent in less than five or six months there.

That is generally taken into consideration in the time given in the specification?—Yes, it is; there are six months given when you state it, but I doubt whether generally speaking, you can ever get it in six months. I have often been much more than that.

That is to say, you doubt very much whether you could get an Irish patent within the time which is allowed for it?—Yes, within the time which is allowed for it; it sometimes happens that a patentee wishes to have the opportunity of trying his invention under his English patent a little, to see how it will work in practice, for it is a dangerous thing for him to try it if it is any thing that is to operate on a large scale; he cannot try it without disclosing it; the consequence is, he says, “I will wait until I have got my English patent that I may try it, so as to see all the bearings before I apply for an Irish patent; if he takes a month or six weeks, it is a moral certainty then he cannot get his Irish patent through before he must specify here.

Did you ever know any instance of any inconvenience?—No sir, I have not known an instance, but I have often had a great suspicion that by the applications that are made and watching the expiration for the time to specify to get the earliest possible information of patents, and in more than one almost watching it with such scrupulous exactitude, that it struck me there was some motive for it beyond the mere general information that is sought for upon these occasions.

You say there is a great delay in it; do you know in what particular office this delay arises?—I do not know what office.

Do not you know when it passes out of the Privy Seal office or the various offices which you have described; do you not know when it is forwarded from one office to the other?—Not in Ireland.

In England?—Yes.

You can tell where the delay generally arises possibly?—The greatest delay is, when from any cause or other the royal signature cannot be obtained; in some instances where the great officers of state are in the country, then a patentee is put to an increased expense, or he will have to wait a month or two perhaps for the privy seal, unless he will pay an extra expense towards a journey; and upon some occasions patentees have actually paid considerable sums to make a journey on purpose where particular circumstances rendered it necessary that they should have the patent immediately, without waiting until any body else contributed towards the expense of the journey.

Several of these offices are merely formal; there is no act done except a signature; there is no impediment ever thrown in the way of a patent?—There is no impediment passing the Signet or Privy Seal office.

Where does it go to after it has got out of the Attorney General's hands?—It goes back to the King for the King's warrant; then the Attorney General prepares a bill for the King's signature which is called the King's Bill; after that is signed, the King's signature is not wanted any more.

In some of these offices is the operation merely formal, and there would be no mischief done if it was entirely passed over?—In a Scotch patent there is a much more expeditious method. I can get a patent although I have to correspond with my agent in Edinburgh; I can get a patent there much more expeditiously than I can in England; in ordinary cases about half the time.

What is the cause of that?—Because it passes by what they call warrant; that is, the King's signature is only had once; as soon as the Lord Advocate of Scotland has made his report similar to the Attorney General's report in England, the King issues a warrant, as it is called, which is a substitution for the King's bill here; it differs a little in form.

Would there be any mischief in having the Scotch form introduced?—I should think it would be a very great improvement.

Is there any practical objection?—I am not aware of any practical objection.

You say that when a caveat is entered before the Lord Chancellor, he has the power of awarding costs; has the Attorney or Solicitor General that power?—No; in one way they exercise it; it is a modern plan; in one way they to a certain

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extent exercise that power, and it arose on a case of my own when Sir Samuel Romilly was Solicitor General. I had obtained his report in favour of the patent, and I had gone back and got the King's warrant, directing the patent to be made out in the intervening time; a person getting by some means knowledge that the patent I was soliciting had been reported on, he came and claimed to be heard on a caveat. I submitted to Sir Samuel Romilly that it was contrary to practice that a party should be heard at that stage, and in addition to that he had put my party to an increased expenditure by not coming at an earlier stage as he ought to have done; that was the first time it was ever admitted of permitting a party to be heard on the bill, as it is called; he then said, "I will let you the opponent in to be heard now; but it is upon this condition," and ever since that, it has been the rule, "that you shall pay the expenses that the other party has hitherto incurred, if I am of opinion the application ought not to proceed, (and I think it has been subsequently altered to a further condition annexed to it,) and if I am not of opinion that it should be stopped, you shall pay the expenses of this hearing." I believe something of that kind in some modern cases has been done. I am not clear about that, because that has not arisen in my own practice; at all events since that time any person coming in the second stage before the Attorney General on the bill, he is now made to deposit some of them, finding the Attorney General had no judicial power to enforce the payment, refused to pay after they had been suffered to be heard. Well then another remedy was adopted, "you shall deposit so much money, and thus it stands now."

You mentioned the expense of a patent; you mentioned a patent having one name; is the expense increased if the patent is taken out by several persons?—Yes.

In what proportion, can you tell the Committee?—I should think, in the Attorney General's office, it is very little; the Secretary of State's office in each stage there, it is 1*l.* 7*s.* 6*d.* extra, in each stage through the Secretary of State's office; I think there is some little extra expense at the Hanaper; there is there an extra expense of 2*s.* 6*d.* or something like that in the Attorney General's office, but there is a very large expense extra at the Signet and Privy Seal offices, for the addition of a name; I have selected those in anticipation, that that would be enquired of me; I have extracted the charges there, as I thought I should not be able to make myself so well understood by words as by putting it on paper, the difference of expense in respect of one name and of two; the expense on one name at the Signet office is 4*l.* 7*s.*; on two it is 10*l.* 5*s.* 6*d.*: at the Privy Seal office it is 4*l.* 2*s.*; on two names it is 10*l.* 0*s.* 6*d.*: so that the addition at those two offices may be considered instead of 8*l.* 9*s.* is about 20*l.* 0*s.* 6*d.*

	One Name.			Two Names.		
	£.	s.	d.	£.	s.	d.
SIGNET OFFICE:						
Fees and Stamps - - - - -	3	1	-	7	13	-
Gratuity - - - - -	1	1	-	2	2	-
Receiver and Assistant Clerk - - - - -	-	5	-	-	10	6
£.	4	7	-	10	5	6

	One Name.			Two Names.		
	£.	s.	d.	£.	s.	d.
PRIVY SEAL OFFICE:						
Fees and Stamp - - - - -	2	16	-	7	8	-
Gratuity - - - - -	1	1	-	2	2	-
Record Keeper - - - - -	-	5	-	-	10	6
£.	4	2	-	10	-	6

Is the expense increased before the Great Seal—the Chancellor?—I mentioned before, it is 2*l.* something; an extra fee at the Hanaper, but I believe in no other respect; which is received by the patent clerk at the Great Seal office.

Sometimes the petition is referred to the Solicitor, and sometimes to the Attorney General, is it not?—They do not make any distinction at the Secretary of State's office; it is referred generally to the Attorney or Solicitor General; then the applicant, the person passing the patent, takes it to which he pleases, where he thinks he is likely to get the earliest report.

That is entirely at the option of the applicant?—Quite so.

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The fees are the same in both offices?—Precisely.

Is it possible so to word the title of a patent as to escape the caveat?—There have been instances, and one arose in my own practice, where patents have been framed with what they call “Blind titles,” for the purpose of escaping the caveats; originally, I should observe, caveats were not permitted to be inspected, and I must say, I think it is exposing patents to great danger to permit them to be inspected; they are at this time of day; originally they were not permitted to be inspected; now since they have been inspected, it was a very common thing for a man, possessed of a little ingenuity, to frame his title so as to steer clear of some particular caveat, or of all of them if he could. An instance of that kind came to my knowledge; I was concerned in it, where this *blind title* escaped a caveat, and I afterwards got information of it, and stopped it at the Great Seal; and from that time there was a fresh rule laid down.

Do you remember what the title was?—I am not sure I remember right what it was; but it was a very common thing then to frame titles as obscurely as possible, for the purpose of evading caveats: the Attorney and Solicitor General’s clerks (who are not men of science generally, who have no mechanical knowledge); the title is worded so obscurely that he could not tell which of the caveats was affected by it, and many caveats have not had the proper notice they otherwise would have had if there had been a specific title referrible to the object for which the patent was to be granted. I think the one referred to was an application for some improvement in the process of refining sugars, and a blind or obscure term was made use of; “Process for improving the quality produced from certain vegetable substances;” now it was so obscure, that my caveat that was entered to stop any process in the clarifying sugar; it did not occur to the Attorney General’s clerk sugar was a vegetable substance; I afterwards got notice of it, and stopped it at the Great Seal; on that occasion some directions were given by the Lord Chancellor that something specific—some definite object should be stated in intelligible terms in the title for which the patent was applied for; in the title of the invention something specific and definite, not in those general, vague and ambiguous terms as the one I am speaking of was couched in.

Does an obscure title vitiate a patent?—I believe not; I am not aware that it has ever been raised; if the specification is obscure that is said to be a ground for voiding the patent.

Or if the specification does not agree with the title of the patent?—Certainly, that is quite clear; there is no doubt about that.

Do you conceive patentees are commonly ready with their specifications within the time allowed for making the specifications?—No, I have generally found them coming at a few days before the time expired for specifying; I have generally found them unprepared until nearly the time was expired, and they are generally got up in great haste at the end of the time.

To what is that owing do you imagine?—In many cases where a man has got it in his mind, and he has not got the practical part when he applies for his patent, and he is afraid to try it, least he should disclose his process; he has got something in his mind which he has not matured, and when he has got his patent he finds his practice differs a little from his theory, and he has got to reconcile difficulties to mature his object before he can venture to specify. That very often happens.

Then would it be any convenience that you should give him more time than is usually given for specification?—I think six months is quite sufficient if they would set about it directly they have got their patents. I think six months is abundantly sufficient, except as referrible to Ireland; you cannot always depend on getting a patent within six months there; and it is open to the inconvenience I before adverted to, that if the Irish patent has not been got through when the person is obliged to specify here, any body could get a sight of it and could communicate information there, which is descriptive of the patent there.

You have mentioned sometimes three months occurs between applying for a patent, and obtaining the Great Seal to it?—Yes.

During the whole of that time the inventor is liable to lose his patent, supposing any body, by becoming acquainted with the invention, makes it public?—Certainly; and he is exposed to more danger because it is known, upon the notice being given from the Attorney General’s office, to all persons who have got caveats on the subject, it is known he is applying that process, he has greater danger. I was taking out a patent for a man, a few years ago, who, on a Saturday afternoon, while

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his patent was in progress, after his workmen had left for the day, one of them came back; he was going into the workshop, he said what brought you back? oh! says he, there is one of Mr. So-and-so's workmen, says his master, has heard you are about taking a patent, and he has come for me to tell him what it is, and I was going to show him what it was; and that often happens, the secret is endeavoured to be obtained when they know a man, who has a number of workmen, inquiries are made about their master applying for a patent.

Would it not be very desirable, if any means could be devised, by which the applicant for a patent should be protected from the moment he makes his application?—I think it would; highly desirable; pending the progress of the patent, if I understand the question right, if it was not known before any disclosure that took place, then not by his own act; but if any body surreptitiously gets possession of it, that shall not be destructive of his patent right, unless it was by some means where it had been used before the application, but not pending it; for it frequently does happen that inquiries are made, and, from some instances where an applicant has been stopped, where I have been concerned, I am afraid information has been obtained during the progress of the patent as soon as notice has been sent upon the caveat.

Do people generally begin to sue out their patents in Ireland, and in England, or do they wait?—They should do it.

What is the practice?—Some do begin directly, but generally speaking they do not begin directly; a man says I want to get my English patent, that I may try my experiment without the danger of disclosure.

Do you propose to secure to a man property in his invention from the time he applies for his patent?—I think it is proper it should be so, provided he ultimately gets the patent, and does not rest on that security, for the great difficulty would be if it was not guarded against in some way, a man would keep his application pending six, nine or twelve months to an unnecessary period.

You mean there should be some further advantage in obtaining the patent, otherwise many would have no object than in obtaining, merely obtaining it?—I am afraid I have not made myself understood; there are many men, who would make the application for a patent, would extend it to an inconvenient length of time, while he was protected, and perhaps afterwards not even go on with his patent; he must not delay it, I should think it would be very inconvenient if he was not to prosecute with what is called due diligence; to go on without losing any time but what is unavoidable.

You have been explaining considerable inconvenience, and very often injury occurs from the insecurity of an invention after an application is made?—Yes; and I think it would be proper to protect him pending the application, provided he did not unnecessarily protract it in its progress.

In order to effect that object, it would be necessary to give the inventor a property in his invention, to a certain extent?—Yes, it would.

How would you accomplish that object without making it necessary that he should specify at the time of his application?—There would be some difficulty, certainly, in doing that. I do not know how it could be restrained if he disclosed it; but, perhaps, the only way that he could be protected would be, that any disclosure of it, pending the application should not void his patent, although his patent was dated after the disclosure. The law at this day is, if the thing has been publicly used before the date of the patent, although after the petition first presented, that destroys the patent.

As to the practice, how would you secure to a man that which he does not strictly define?—I should say, just in the same way as you do now under a patent; you secure a man to-day by a patent that which he does not define for six months time to come; but when he does define it, it goes back to the time of the date of his patent, as if he had then defined it. The King grants a patent to-day; the patentee has six months to specify in; he is protected in that intervening space of time, when, at the expiration of six months he puts in his specification, he is in the same situation as if he put in his specification at the time it is sealed.

Might not the man under those circumstances make an application without specifying, and in the interval between his application and the issuing of his patent, in which the specification was to be contained, might he not hear of some extension or improvement upon it by some one else, for which that other person had applied, and that he might include in his specification?—I can only answer that by saying, the law has been laid down, that if a man discovers any improvement in the intervening space

space of time between the granting the patent and the specifying, there is a modern decision on the subject, that he is at liberty to include that, for it is the result of his experiments to mature his invention.

It is not an improvement by the inventor himself, but an improvement by some one else who had brought a better invention?—Then the law would be as it is now. I, who take my patent for one thing, I am secured in it; any other person who has found out something being an improvement on it, he is entitled to an exclusive right of that improvement if he could use it without my invention; but not to incorporate and to amalgamate mine with his without my permission; that is the law as it stands at this time.

In cases, then, where a property is given in an invention before specification, would it not be likely to occur that a person obtaining that property, would have it in his power to include in his specification that more efficient invention, with the same object which might be produced by another person during the interval?—He might do it, but it would be at his own risk of destroying his patent if the thing was discovered.

For the sake of guarding against that inconvenience, would you think it desirable that a person applying for a patent, should at the same time give in a sealed description of it, to which reference might be made hereafter?—I should think that that would be a very desirable way, if it were practicable; but then it would come round to this, that many men would say, “My invention is of that large and that extensive nature, that I cannot make such a specification by anticipation as it were, until I have had the opportunity of trying it, as would disclose all its properties; and if I am to be bound by that, perhaps it may only be half the object that I am entitled to, it may embrace but half the object I am entitled to.”

Would not that amount to the same thing as compelling the applicant to enrol his specification at the time of his application?—I have thought a great deal about it, but I could not arrive at a conclusion that it would be beneficial, on the whole, to make the man enrol his specification immediately he applied for his patent, or immediately he got it.

Do you think that it would be possible for the applicant to put in, as proposed, a description of his invention, although it might not be possible to draw out a legal specification at the time?—If it is to be of any utility, it ought to be a specification; if a man is left to enlarge it, or contract it, it is open to all the mischief you are attempting to guard against; it ought to be perfect, or it is of no utility.

Might not a person describe some principle or other from which his invention afterwards might be fairly inferred to have arisen?—To give some outline of it, but not embracing the means, the Committee mean.

Yes?—I do not see why he should not be called on to state it more specifically in his title, if he is not to disclose his process, but then the title would be very long in many instances; in France, they are obliged to deliver a specification at the date of the patent. I do not see how the deposit of the principle of his invention, or the outlines of it, affords him any protection; it is rather, I should submit, a protection to others that he shall not embrace any thing under his patent that he had not really invented.

Do you conceive any improvement might be made with respect to the caveat at present; suppose, when a caveat is entered, that the invention was referred to a commission of scientific men, instead of being referred to the Attorney or Solicitor General, to determine between the two applicants; would that be a more satisfactory mode?—I should hesitate much in considering that it would.

Why?—I think it would be attended with great danger to patentees; I think it would be productive of favouritism.

The Attorney and Solicitor Generals not being usually scientific men, does not great difficulty arise, at times of caveats being opposed, in informing them of the real nature of the invention?—Sometimes those difficulties do arise, and I have known them call for scientific information for their own guidance; I remember Sir Thomas Plumer did that, and some others; I remember Sir Thomas Plumer in particular, he called for some information from a scientific man conversant with the subject, and I think it has been done in other cases; he would call in an indifferent person. In short, the subject of patents is so pregnant with difficulties, that you are choosing among difficulties.

Might not the information given by the Attorney General to any persons called in upon the opposing of the caveat, be construed to be a publication of the patent?—I think not; and the Attorney General would have no difficulty in framing his

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question so that the person to whom he was addressing it, should not get the precise information of the object to which it was referrible.

Have you any doubt it would be desirable that the Attorney General should have assessors composed of scientific men to assist him in judging?—He has the means of doing that now; if he is at a loss on any subject, he can get information.

What means has he of paying for that?—I do not know whether he pays them at all.

But if you gave him authority to do it and power to pay such persons for their trouble, would not that be a more satisfactory mode?—I certainly should prefer that to a standing board, as far as my humble opinion goes.

What do you think of the propriety of appointing assessors to judge, or commissioners to judge of the sufficiency of the description contained in the specification?—I am not quite prepared, and I should not like to speculate on a thing with which I am not sufficiently acquainted; I should have some doubts about it.

Would it not add to the security of patents, as it would prevent their being set aside on the ground of insufficient descriptions?—And their opinion to be final and conclusive upon that subject?

That is the view contained in the question?—I should have great hesitation in saying that that would be quite advisable; there is so much difference of opinion on abstruse subjects until it is put to a public test, that I am not quite prepared to say any three men would always draw a right conclusion.

Do you think the public at any time during the whole continuance of the patent ought to have a right to question it on any ground?—It is a hardship on the patentee I know, but I do not see how to remedy that difficulty without letting in a greater; it has been talked of; I have had many inquiries made of me about permitting a man to enrol his specification; the answer I have generally given on that is, if you were to do that he would embrace fifty things when he was only entitled to one, if he was afterwards at liberty to put in a new specification, and then he would only claim that one.

Is it not a very common practice, for the purpose of misleading the public from the real nature of the invention, to multiply the number of modes of effecting that object, without particularly specifying that one upon which the inventor really depends?—That many specifications have been framed very obscurely, and my own opinion has been with that view certainly, but that is only matter of opinion; I cannot state it.

Would not the referring the specification to a commission, to judge of the description being or not being sufficient, be of advantage to the public, inasmuch as it would prevent that practice just alluded to?—If the Committee would allow me, perhaps I should sooner get at an answer to that question if the Committee would allow me to ask, whether it is to be before or after the specification, is the patentee to go to these three scientific men with his specification before he has put it in, because there would be considerable difficulty in the patentee being restricted; they perhaps might say he has only two or three modes that we think good, you shall not take the other seven; the patentee might say, I consider that I am entitled to ten modes, and I should not like to be restricted to three, or I am entitled to three; I can do it three ways, and I should not like to be restricted to one; before I answer the question I must understand whether the Committee meant it to be previously or subsequently to the enrolment of the specification.

The question contemplated, that sufficient time should be allowed to the party as at present between the application for the patent and the enrolment of the specification; but before the specification is final, and before the patent is sealed, that a commission should examine whether the invention is adequately described in the specification, would not such an examination before a commission insure to the public a complete description of the nature of the invention?—I should think it would be so; but I am not sufficiently in possession of scientific knowledge to form a correct opinion on that point; there are many other persons more conversant with such matters, who are better able to answer that question; I own I feel difficulty about it.

In a chemical invention, for instance, if the commission was to superintend the process, to see that the chemical preparation can really be prepared by the mode described, would not the appointment of a commission for that purpose have a beneficial effect for the public?—It is probable that it would; but I am not quite competent to form a satisfactory opinion on it.

Is it not advantageous to the public to know really what the nature of the invention is?—Certainly.

Then, instead of leaving it to the honour of the patentee to describe clearly what the real nature of the invention is, would it not tend to make that matter more clear to the public if a commission was really to investigate the nature of the invention described in the specification?—Very considerable difficulty might arise upon it: a patentee might not be satisfied with these gentlemen's decision, and then it would follow perhaps as a consequence, that he is not to have his patent after he has gone to the expense of it; I have seen very great difference of opinion among scientific men.

Have you seen much difference amongst scientific men on the point, whether the invention is or is not adequately described?—Certainly I have; certainly I have very great.

In making these discoveries, you have frequently found, have you not, that the practice in a great way differs from the anticipated effect derived from small experiments?—I am satisfied that when a patentee can, without fear of the danger of disclosure, make his experiments upon a much more extended scale than he has thought himself safe in doing while his patent is in progress, I have no question he has frequently improved his object very materially.

But is it not also found, that results which have been anticipated in study, when they come to be put together, are not produced by the machine when put together?—Yes.

Constantly?—Yes.

Then the patentee himself can hardly predicate with certainty what will be the result of his own machinery in nice operations?—I am quite sure that is very often the case.

In chemistry, does not a great deal depend upon manipulations and small details, which, if they were described, it would be utterly impossible for men of science to know if they would produce the result promised; as for instance, in making a dye, might not the boiling for five minutes, or ten minutes, most materially alter the result of the colour?—I should think that very probable.

If it was prescribed in the patent the dye should be boiled ten minutes, no man of science could say with certainty the colour promised should be so produced, should you not expect that?—I am not competent to answer that question.

If it could be shown that, from insufficiently describing the time, or of any part of the manipulations, the preparation could not actually be prepared in consequence of such insufficient description, would not the patent be liable to be set aside?—Certainly.

Is not a patent always as obscurely drawn at present, as the specifier thinks consistent with prudence for the legality of the patent?—I believe that is done so sometimes; I have no doubt it is done; frequently it is an object to say as little of the real merits of the invention as is possible; I have no doubt of it.

Is not the principle upon which the granting of patents is founded, the giving a person monopoly for a limited time, for the purpose of making known to the public the nature of a beneficial invention?—That is the object certainly.

Then would not any contrivance which should make known to the public what the real nature of the invention is, be more consistent with the object of the patent than the present practice is?—It might be, if that object was attainable; but I am not quite prepared to say that there would not be considerable difficulty in it: they are to exercise, I assume, a discretion; and a patentee might be told that this Board differed from him; and, unless he put it in some shape that they approved, that he should not have his patent. I am not quite clear that that might not be a very great hardship on a patentee in some cases and upon many subjects; there certainly is difference of opinion upon many new principles, or the modes of reducing them into practice.

But it would not be, in this case, a question, how they should be reduced to practice, but whether the method which the patentee asserts will be adequate to reduce them to practice, is or is not adequately described?—It might I dare say be, in some cases, beneficial; but I am not prepared to say it would in all.

Supposing the Attorney General was directed to appoint an assessor, subject to challenge from both parties disputing the patent; would you suppose that they might be brought to agree on the appointment of a scientific man?—The applicant and opponent might be brought to agree on him?

That is the question?—Perhaps, in many cases, they might.

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In cases where there were double applications for a disputed invention, it is now submitted to the Attorney General. Supposing the Attorney General had the power of appointing an assessor, whose appointment was subject to challenge from either of the parties; would they be likely finally to agree upon some scientific person who he might appoint in most cases?—I should think they would oftener disagree than agree on who should be the assessor, if the Attorney General had not the power to call in such a person as he thought proper or approved. If they differed as to him, the Attorney General to call in a third.

Supposing the Attorney General appointed a scientific man, and he was objected to, the party would state his reason, and the Attorney General would then appoint some one else, if the reason was good; do you imagine, in such a case as that, they would not be brought to agree to the appointment of a person?—If the Attorney General has the power of the appointment, if it is to be decided by means of an assessor, I should say it would be better the Attorney General should call in any persons he chose.

Are there not very minute details, that occur in many cases, the necessity and full effect of which, can only be appreciated in the particular trade to which they relate?—Generally speaking, it is so.

Must not any commission that should be appointed, be formed of persons of that particular trade?—I should think they ought.

Would that be advisable?—I must say I should doubt the propriety of that, certainly.

Do you conceive, in that instance that has just been mentioned, the decision is likely to be more satisfactorily made by an Attorney General who can know nothing about these trades, or by scientific men who might be selected for their peculiar knowledge of them?—I should say, it does not often happen that there is any difficulty that the Attorney General cannot decide; it is not of very frequent occurrence that he is not capable of arriving at a proper conclusion in deciding it.

Now, take a chemical invention; for a chemical discovery how is an Attorney General, who is not acquainted with chemistry, to ascertain whether the mode proposed is capable of producing the effect stated?—I should say that is one of the exceptions to the rule.

Are not very many patents granted for chemical inventions?—Certainly.

In all those cases the Attorney General is not a competent judge?—If there was an opposition before him he might, and it is more than probable he would find some difficulty; but when he hears what each party has to say; first hearing the applicant, not in the presence of the opponent, then hearing the opponent, not in the presence of the applicant, seeing where the interference, if there is any arises, he can generally put questions to one and to the other; question upon question, till he can arrive pretty nearly at a correct conclusion.

Do you conceive he ever can come to a satisfactory conclusion, as to whether the mode of producing a chemical result is properly set forth by questions without experiments?—I do not know; I am not speaking of the specification.

The Committee are?—I understood the question to be referrible to an applicant and an opponent in the previous stages of granting a patent, and where the Attorney General was to decide between the parties, between one and the other; the Attorney General has nothing to do with the specifications, it is only to decide upon interference or no interference at the commencement.

The question you have been asked by the Committee went to the propriety of appointing a commission to examine the specification, in order to ascertain whether the thing was properly described or not?—I must say, I doubt the practicability of it; the vast matter that must come before them that they cannot be competent, any three men, to decide on every thing that must come before them.

Is not your answer founded on the supposition that it should be a permanent and unchangeable commission; if the commission was only appointed *pro re nata*, then would the objection you have last stated be removed?—I can only answer as matter of opinion that I doubt the practicability of it.

Supposing each party was to appoint scientific persons, and that those two persons so appointed were to select a third, and to proceed to an examination in case of a disputed application, what do you conceive would be the effect of that?—As referable to whether it should be decided by the Attorney General or in this way?

Yes, that is the meaning of the question?—It is a difficult thing to answer in all its bearings, as it might perhaps in some few instances be beneficial, but as a general rule I do not think it would.

Do

Do you not think that scheme would produce fraudulent caveats and fraudulent attempts to attack the patent, for the purpose of establishing it afterwards; might not two parties come to an understanding, one with the other, that they should make an objection and be heard upon it before the Attorney General, for the purpose of establishing a patent which might otherwise be bad, and by that means introduce fraud into the system?—The Attorney General's merely reporting in favour of a patent does not conclude the question.

Can you give the Committee any information about the law of patents in France or any part of the Continent?—No, I cannot. I have generally declined having to do with them, but I have understood at the application for a French patent, you must deposit a specification.

Have the goodness to state whether or not instances of opposition for the same patent have been entered for different parties?—There are frequently five or six opponents to an application.

Now does one expense on the part of the inventor suffice for all that?—Yes, certainly.

Do you know several oppositions sometimes arise from one quarter, or not, fictitiously originating from the same party under different names?—I have heard something on the subject in conversation, and I have entertained a suspicion that there has been collusion of that kind practised, but to what extent I do not know; but I certainly have had suspicion there are collusions sometimes entered into, but how often I cannot say, and it has not very frequently come under my consideration; but that I have on some occasions thought there was collusive opposition, certainly.

Can you state how a person who has omitted to lodge a caveat, learns what patents are preparing?—He may get some of the knowledge by searching for caveats, and I believe at the different offices through which it passes, if he inquires he may be informed; if he inquires for any particular subject, I do not believe he would get general information of all that was going on; if for instance I was to inquire at the different offices, "Is any thing going on about the steam engine," I dare say I should be told if there was or was not, and if there was, I think I should not experience much difficulty in obtaining the name of the applicant and the title of his invention.

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Mr. *Francis Abbott*, again called in; and Examined.

DO you think it would be advisable to print the specifications of existing patents for public use, in order to publish them?—I have generally considered it would be prejudicial to the interest of the country, by their getting abroad, I am speaking of it in a national point of view, sending many valuable discoveries abroad; many of those things perhaps would be bought from English manufacturers, but if the specifications all go abroad they would be more likely to be made there than they would be if the information was not so circulated.

Do you think that it would be advisable, that copies of the specifications should be entered in the different manufacturing counties, so as to be accessible to the public there?—Any person wanting that information, and residing near a country town where the specifications are entered, would certainly get it much cheaper if he could go and inspect it there, than by coming up to London to inspect it, or writing to somebody to procure him a copy.

You are aware that titles of patents and sometimes the specifications are published in public journals?—I am aware that there are different periodical publications that contain several of them, but not all; they have a regular list of all the patents, but they generally have a limited number only of specifications. The *Philosophical Magazine* used seldom to have more than two or three in a month; the *Repertory* I think used generally to have four in a month, and that upon the average would be about forty-eight or fifty in a year, when perhaps there have been sometimes nearly two hundred patents.

What is the expense of inspecting a specification?—At the Petty Bag Office it is three and sixpence; at the Rolls Chapel Office it is three and sixpence; at the Inrolment Office it is a shilling; they have none but modern ones there, for when they have got ten or fifteen years they hand them over to the Rolls Chapel Office,

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so that they never have more than that limited number in their possession at that office.

Supposing a person is desirous of inspecting a specification, has he any means of knowing which office it will be found in?—No, I think it is a great grievance that he has not; he sometimes has to pay for searches at two or three before he finds it.

Would it not be much more convenient to have them all in one office?—Indisputably so.

Do all specifications, that are considered of any great importance, find their way into the public journals?—I do not think the importance altogether regulates that, it is a matter of convenience which the publisher considers; sometimes they want a long one because they have a scarcity of matter, perhaps at other times a short one is more convenient; and they frequently do not take those with drawings because they then save the expense of plates.

Is not influence sometimes used with the editors of the journals, to induce them not to publish specifications which the inventors wish to keep secret?—I have no doubt that is sometimes the case.

When a person has inrolled his specification, what becomes of the copy, that is to say the original deed?—It is delivered back to the solicitor or the agent who brings it for enrolment.

And the copy of that specification is what you keep in the office?—The enrolment of it.

Is that original deed, which is returned to the inventor, good evidence in a court of law?—No.

Supposing a trial in a court of law in which it is necessary to give in evidence a specification which has been inrolled, is that copy which has been given to the party good evidence of that specification, or is it necessary to obtain either the original roll or an office copy of it?—The production of the specification is not good evidence of it. The proper evidence is an office copy; or in many instances, in London, we used to attend with the originals, as less expensive to the parties; but Sir John Leach has lately laid down a rule, that he will not suffer the original rolls of the court to be taken out when office copies are admissible evidence: office copies are admissible evidence upon trials.

Are they admissible evidence without calling the copyer or the officer of the Inrolment Office as witnesses, to prove the authenticity of the copy?—Some person must come to the office and examine the copy with the original record, and then he must attend at the trial and say, This is a true copy of the record in the Petty Bag Office, or in the Inrolment Office, as it may be.

Is the simple indorsement upon that copy made at the Inrolment Office, received as evidence on the trial of the authenticity, as is the case with the indorsement on a deed, when it comes from the Register Office of Middlesex?—The certificate of the officer is not evidence either of enrolment or of the authenticity.

Would it not save expense upon the trial if the indorsement made at the office were received as proof of the authenticity of the copy?—Certainly; and that principle has been adopted in another court, where, to save the expense of that mode of giving evidence, an Act of Parliament has been passed, directing that any certificate, purporting to be signed by the officer in whose custody the document is, shall be evidence of itself, without proving his signature to it.

Is the inventor allowed to take his original specification and verify it, by comparing it with the inrolled copy previous to trial?—The original specification is not then evidence; it must be an office copy examined with the record.

Would it not be a great saving of expense to the parties, if they might take the original specification and compare it with the inrolled specification, and then give it in evidence?—It would certainly be a saving of expense to a patentee who was litigating his rights.

The saving would be in avoiding the expense of a new copy?—Yes; and that sometimes is a very serious expense; sometimes they are very long. I have had several specifications in the Petty Bag Office, copies of which would come to forty pounds, or sometimes more than that; there is such an immensity of drawings attached to them; I think I have had some twenty or thirty skins of descriptive matter, and perhaps fifteen or twenty skins of drawings attached.

Even in such a case, would not a new comparison of the original copy with the inrolled copy be necessary, in order to see that no interpolations had taken place?—I should think it would be proper, or else some alteration might be made that would

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would be an obstruction to justice, if it was not proved that in its present state it has been examined with the record, and that it agrees with it.

Would it not be beneficial, if instead of returning the specification to the party, it was retained in some office, so as to be capable of being produced on the trial if it was wanted?—Then there would be an expense if it was to remain with the officer; that officer would have to attend to it, and it would come to the same expense, perhaps, as the production of the specification, and in some instances that is more than a copy; because there are some specifications that we have a copy of which would not cost above a dozen or fourteen shillings, and the officer's fee for attending with it would be a guinea a day, exclusive of a petition presented to the Master of the Rolls for liberty to take out the record. If I am to understand that it is to remain with the officer as a record, it must be dealt with as other records are.

Would the expense in that case of attending with the original specification, be much greater than is incurred now of a clerk attending with the copy?—The attorney sends his own clerk; we do not attend to authenticate the copy; we make the copy, and the attorney sends his own clerk; or if it be a subject that requires scientific information, such as where there are drawings and shading and scales, and so on, he will send an engineer to examine it; but there are some specifications which do not cost more than ten shillings or a dozen shillings; then an office copy is much less expensive than producing this record; which I understand is to be considered as deposited of record, instead of being inrolled of record.

The ancient practice of producing the original record was inconvenient, was not it?—I think it was dangerous, and ought never to be resorted to, except in cases of indispensable necessity; in the case of criminal prosecutions, office copies are not admitted in evidence, and the originals must go; also before either House of Parliament or any Committee, they do not receive office copies except as a matter of courtesy; sometimes the original is dispensed with; but generally speaking, either House of Parliament, and any Committee of either House, has the original records.

Do you think it would answer to leave it optional with the party to return the specification or not, so that if it was a very long one he might then leave it and let it be of record?—Unless the rule was general, I am not quite prepared to say, whether it would have the benefit that might otherwise result from it if it was general; because if it is to be a general depository, people would always expect to find a specification there, and going there and not finding it, would be attended with expense in pursuit of it.

Do you see any objection to allowing the patentee to take his original specification, and verify it at the office, so as to make it good evidence in a court of law?—No, I do not see any objection to it; it is pretty nearly what I believe has been done in another case under the Bankrupt Act. There are certain deeds of bargain and sale and assignment of personal property, they are directed to be registered; which is in substance inrolling them; and under that Act it is provided that they shall be received in evidence, bearing a certificate purporting to be signed by the officer that they have been registered, without even proving that officer's signature; if it purports to be his, and that is certainly a very beneficial provision, it saves a great deal of expense.

You mentioned that there are very large drawings sometimes attached to a specification, is not the present mode of keeping the rolls rolled up, a little inconvenient with respect to drawings?—Speaking of the mode of keeping them, as a whole, I think it is the best way.

Would you think it an improvement to have them in books?—I think not; they are better preserved, I think, in their present form than in books, for you can seldom get books to stand long without binding, when they are in constant use. We have some books in the office and some rolls, and I think the rolls bear the wear of use better than the books do.

Do you allow extracts of specifications to be made?—No; as a kind of gratuitous privilege, we say, No extracts are allowed; but just to refresh your memory with the outline, we do not object to your taking the name and address of the patentee, the date of the patent, and the title of the invention; but not any extracts of the descriptive part. In short, it would be productive of great inconvenience, independently of the loss of emolument to the office, if extracts were allowed; we could not say whether a gentleman should be occupied five minutes or five hours.

Where would be the objection to allow parties to consult patents, upon taking a fee, as is the case at the Register Office of Wills, where each consulting party

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pays a fee of a shilling?—I believe they have that privilege at present; they may come and look at a specification; the only difference is, that the fee is 3s. 6d., instead of 1s.

Can they make extracts themselves?—No; nor are they permitted to make extracts from wills. I have had occasion to make many searches there, and I have many times been told, even by anticipation, Sir, we do not allow extracts.

What is the expense of obtaining copies?—That depends upon the length; we have them as low as 10s. or 12s. up to 40l.

What is the rule of charging?—Seventy-two words is what we call a folio, and that is the rate of charge; and then there is an official fee of 3s. 4d. for the signature; and for the attestation and indorsement of a certificate there is a stamp duty.

If a person takes out his pocket-book, and, with a pencil makes a few extracts, do you actually stop him?—If any gentleman is going to take an extract, and we observe it; but we do not watch with that minuteness, that a word or two could not be taken, nor do we keep looking at him while he is inspecting it; but if it is so plain that we cannot but observe it, we say, Sir, no extract is permitted to be taken.

May he stay long enough to learn it by heart?—I have had frequent instances of gentlemen being two, three, or four hours, where the specification has been long, and they have not been able to finish the search before the office has been closed; I have said, We cannot attend you any longer now, but you may come again, and I shall take no further fee.

It appears, that in some of the bills that have been given to patentees, there is a charge for gratuity; can you explain what is meant by that?—It had its origin in expedition; in short, they have two gratuities there.

Has that the effect of hastening the patent through?—I think, in modern times, it has not.

Can any errors or omissions be rectified in a patent after it is sealed, or in a specification?—There have been some few instances where, under particular circumstances, some which might be deemed clerical errors, have been allowed to be corrected; the Master of the Rolls has the power, and he has in one or two instances exercised it; but not as to the substantial part, the description of the subject-matter. In one instance there was a mis-recital of the date of the patent, which he suffered to be corrected; and there was some other mere formal matter, but I do not know any instance of any correction being made in the substance.

In point of fact, could the Chancellor himself give that power?—It is difficult to say what he has the power to do; but I believe he has had an application, and refused it in more instances than one.

You state, that some of the specifications are stated in the monthly journals; are those specifications to be entirely depended upon for their accuracy?—Not in all cases. I think, generally speaking, they are tolerably accurate; but I think in some instances they are a little abridged, and the scale of the drawings is reduced; you cannot depend upon accuracy after that, because there must be a corresponding reduction in the whole, or else the scale is lost.

Will you state what means an inventor has of ascertaining what patents are applied for, and are in progress through the different offices?—The only way of knowing that, is by going to the Attorney and Solicitor Generals, to see what reports they have lately made in a given time; then, prior to that, all the patents are recorded at the Great Seal Office.

Can a person, who has not lodged a caveat, obtain that information from the Attorney or Solicitor General's Office?—I have obtained it; I have said, Have you had lately any patent upon such a subject? he would look over his book, and say, Yes, there is one lately reported upon. But I am not sure that it is always to be relied upon.

Did you obtain that information as a matter of favour, or as a matter of right?—As a matter of favour.

Can you not get that information at the Patent Office, by paying the fee?—That is after the patent has passed, not during the progress of it; there are two stages before it gets to the Attorney General's; then, as soon as the report is gone out, there is an entry of that report; and I have made the inquiry, perhaps, in more instances than one, and I have been told there is a patent now in progress upon such a subject, or there is none within such a time, and then from the time he has told me, I know that anything else must be at the Great Seal Office,

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Is the favour by which you obtain that information, given merely by the office in which it happens to be, or by courtesy of the parties who are passing it?—Rather as a matter of civility by the Attorney General's clerk or the Solicitor General's clerk: either of them I dare say would tell me, if I asked them, Have you had any thing upon the steam engine within these few months? and he would look and say There has been a report.

Then in point of fact, an agent in the habit of taking out patents can, unless he was particularly unfriendly with the different clerks, be able to obtain such information?—I have never been refused it when I have asked it.

Have you had any practice in obtaining extensions of patents by Act of Parliament?—No.

Have you had any experience in defending patents?—I have had some experience in endeavouring to protect a patentee; but unfortunately, after a long contest he failed, after trying the cause two or three times at an immense expense.

Can you state what are the most common grounds of defence which are set up by infringers of patents?—They are various, but mostly the insufficiency of the specification; and there is such a wide field, that it is difficult almost to enumerate all the grounds that they take upon the specification.

Is not this one of the grounds upon which a patent is often set aside, that the inventor specifies one material and uses a cheaper material not specified or included in the patent?—That has been acted upon as one ground for vacating a patent.

Has that ground of objection been held valid?—I think so.

Must not the specification have been fraudulently prepared?—I remember a case which is a reported case, but I own I thought it was very likely to have arisen by accident.

If, subsequently to the specification of the patent, a person has *bonâ fide* discovered a cheaper mode, would that set aside the patent?—Certainly not; the person who has discovered the cheaper mode, would be entitled to use that without a patent, provided he could do it without the original patent to work upon.

Must not the ground of setting aside the patent be, that the person at the time of taking out the specification knew the cheaper method and omitted to specify it?—I am not aware that that precise case has arisen, but I should think that would vacate his patent; from the current of decisions that have taken place, I think it would be presumed that his object was to mislead the public in keeping that secret back.

Is not another ground of setting aside a specification, that some beneficial part of the process is omitted?—That certainly is one, and I think a very just ground.

Do you conceive that that could ever happen inadvertently?—I think it is difficult to suppose such a thing, I think that is a very proper ground to vacate a patent upon.

Is that rule construed liberally or strictly by the courts?—Generally speaking, I should say that the courts are not very liberal to patentees.

Is not another ground of setting aside a patent, that something useless, superfluous or redundant has been included in the specification?—That has been a question that has been left to a jury, with a direction to take into their consideration whether it was not introduced to mystify the thing.

If it is considered that the real object has been to mystify, do you think that would be a good ground for setting aside the patent?—If I was sitting as a jurymen I should, certainly, because I think a patentee should deal honestly in return for the privileges he gains by his patent.

Is a patentee ever allowed to give evidence, to show that any omission in his specification arose from inadvertence?—I think not.

Is not the specification very seldom prepared by the inventor himself; does not he frequently employ his agent to do it?—He frequently employs an agent; but in a matter of importance, he frequently employs such a man as Mr. Farey or Mr. Donkin.

Supposing it should be found that the specification has been inaccurately prepared by one of those persons, would the inventor be allowed to give evidence of his having desired him to prepare as good and correct a specification as could be made?—I think that would not avail him.

Is not another ground of setting aside a patent, that something has been specified which will not produce the predicted effect?—That is a clear ground for vacating it.

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If a part only of the patent were thus shown not to produce its effect, would that part vitiate the whole?—It would; that was the unfortunate result of the trial that I was engaged in so long and at such an enormous expense; the patent was for three things, one of them a most valuable one; but the patentee failed in one of them; two of them were found good, but the third was the most immaterial part of the three; and he was held not entitled to recover, because one of the three objects was not new.

Would it set aside the patent, if the person had included something in the specification, of which he had not tried the effect?—He puts it in at his peril; but if it would produce the effect, it would not vacate the patent.

Is not another ground of setting aside a patent, the specifying some step that is not new, and not noting that fact, whereby the patentee was held to have assumed what he did not invent?—I believe there have been cases which have gone that length, but I think, at this time of day, the law would not be carried to that extent.

Do you think, if it was a minor point of little importance, the patent would still stand?—I can only say, that in some points of minor description, patentees are now dealt with a little more liberally than they were some twenty or thirty years ago; in Lord Kenyon's time every little thing would set aside a patent.

Is not another ground of setting aside a patent, that the whole article is specified as invented, when the patent should have been for an improvement only?—I should doubt that position a little; if the specification described an implement that would work and perform its office, I think at this day, merely because he had called it a new article instead of an improved article, the patent would not be vacated on that ground merely.

Supposing, in a specification, you had to mention a portion of your process, which was old, and that you failed to do it completely, so as to be quite understood that you did not claim it as a portion of your patent, would that not vitiate it?—I think it would; if a man so amalgamates with his new invention that which is old, and does not distinguish the two, he claims more than he is entitled to, and forfeits his patent.

Would it not be desirable that a man should be compelled to make known to the public any improvements that he might make to his invention, subsequently to taking out the patent?—Not, unless he was protected in the exclusive use of them; that he can do by taking out a patent for improvements upon his former invention.

He could only do that by incurring the expense of a fresh patent?—Certainly.

Do you see any advantage at present from requiring a separate patent for each of the three kingdoms?—I not only see no advantage, but I think it is putting the inventor to a very great and unnecessary expense. But if the law were altered so that his patent should embrace the three parts of the United Kingdom, he should enrol his specification at each, although he has but one patent, at Edinburgh, Dublin, and London, as he is now obliged to do.

Supposing a patentee takes out a patent for England, he is only now subject to a certain expense; if he takes it out for Ireland and Scotland the expense is greatly enhanced; now if one patent was to be made to extend to the three kingdoms, would you require from the patentee the same payment for the one patent that he would have to make now in the event of his taking out a patent for the three kingdoms?—A man ought not to pay so much certainly for taking out a patent confined to a limited jurisdiction as if it extended to the whole; I assume, that if the three kingdoms were to be consolidated, and one patent was to be sufficient, that the expense would be considerably reduced, and that he would only have, perhaps, to pay for that more extensive patent what he pays now for an English patent only.

Then you would propose to reduce the expense?—By consolidating the jurisdictions; but then this difficulty would come round, how is it to be legally known in Scotland and in Ireland that there is such a patent right there; I do not see how there could be official notice of it, unless it was to be put into the Gazette, or something of that sort.

Do you think that, practically, many persons are deterred from defending their patents, by the uncertainty of the law at present?—I think they are.

Are you aware at all, that sometimes fictitious suits are instituted for the sake of giving stability to a patent?—I have heard of that being done in more cases than one.

Is it not a very common feeling, that a patent is of very little value until it has had at least one verdict in its favour?—I should say, that that gave it a little additional sanction; but I have not heard it specifically objected to a patent, that it has

has not been tried; for a scientific man can give you pretty good information upon the specification, if you let him have time to consider it.

But those fictitious suits have been instituted for the sake of giving greater value to the patent?—Certainly, perhaps to deter some one else from defending it, who otherwise would have defended an action for infringing it.

Could you furnish the Committee with a detailed account of the whole expense of taking out a patent?—Certainly, I will do so.

Do you conceive, that any injury could arise to the public, from the specification, after the patent is sealed, being kept unsealed entirely, unless at the option of the patentee himself, who might chuse to take it out for the purpose of defence in a court of justice?—I think inconvenience would result from that mode, because it is one object of the specification that a man shall know when he is infringing the patent; and if the specification is not open to inspection, a man who has invented something of the same kind does not know whether he can work it with safety, because he cannot see what the patentee claims under the specification.

Are you aware of any inconvenience arising from that in France?—I have uniformly declined to have any thing to do with French patents, because I have conversed with several people about it, and I never found one yet that derived so much fruit from a French patent as to remunerate him for it.

You said, that the disadvantage of concealing the specification would be, that other persons might infringe the patent without knowing it; would not that at once be practically remedied by the patentee giving notice of it to the person who was so innocently infringing his patent?—All that I can say is, that as soon as a man infringes a patent, he is liable to an action, and it is not every patentee that would use that forbearance when his patent is infringed.

It is assumed that under the different state of circumstances supposed in the question, he would not be infringing it because the law would be changed?—That would lessen the inconvenience; but there is another inconvenience resulting from it. If his specification could not be seen for fourteen years, it would very likely turn out, that at the end of the fourteen years he had not given half his process, unless it was ascertained that he had given it fully, then he would have had his monopoly for so many years without giving the public the benefit of his discovery; at the end of that time if he has got his patent, and his specification is locked up, nobody can say that he has not disclosed it fairly, because nobody can see what the specification is.

Have you any further suggestions to offer to the Committee upon this subject?—Since I was examined before, I have thought about the expediency of having a board to decide the sufficiency of a specification, and I think it might be injurious because the public are not fairly represented there, and they are to be concluded by it; because if this board adopts a specification as sufficient, I understand it is to be conclusive against any person questioning the sufficiency afterwards. Now a patentee coming before that board, may not disclose all he knows of the subject, or if he discloses all yet he may not disclose all that others could have said if the public had been represented, if a kind of investigation for and against had taken place.

Suppose that the proposed commission were authorized, either to have models made of the machinery, or in the case of a chemical discovery, to see the thing actually made by experiments; would not that obviate the objection?—The difficulty I feel is, in finding any body of gentlemen possessed of powers to determine upon every new invention that must come before them for consideration.

Is your objection that you do not think any permanent board could be qualified for the duties that would necessarily be attached to it?—I think not.

Supposing a body of Commissioners were appointed for the occasion, selected for their peculiar fitness; might not that obviate your objection?—If one part of the board were to be confined to one subject of invention, and another to another, that might in some measure obviate the difficulty; but still I think the difficulty would not be quite removed, for I think there are many new inventions that almost none of our scientific men are capable of forming a correct judgment upon, otherwise than as it is communicated to them in a great degree by the patentee. It is difficult in my opinion to get a board so constituted as that they would be able to discharge all the duties devolving upon them. The difficulty is, that you would not find men capable of discriminating minutely upon every branch of art or science that should be brought before them.

Supposing the Attorney General or the Secretary of State had the power of selecting individuals *pro re nata*, might not a commission of that sort be useful?—

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I am hardly competent to answer that question; I must honestly confess that my opinion is against the adoption of such a board. Independently of which, the public who are to be concluded by it, would not be adequately represented there, for you do not always arrive at the whole truth without opposition, if I may so express myself, now there would not be that opposition.

Does it occur to you, that even very experienced men might overlook some part of a minute operation?—I think so, and that is one difficulty which I have.

Do you ever observe in specifications that things are put into the specification for the purpose of concealment, which are not necessary for the due performance of the operation?—I have no doubt that there is a great deal put into many specifications to mystify them, to obscure the transaction as much as possible; and I could furnish an instance in which it has made my head ache to endeavour to make out the sense that we supposed was to be communicated by it, there was such a multiplication of terms, and ringing the changes upon words, which perplexed and bewildered me beyond measure.

Are there not sometimes parts of machinery inserted as necessary, which are not necessary; and are not parts of a chemical operation stated as necessary, which are not so?—That a great deal of matter is introduced into specifications, that is unnecessary is quite clear; and it is done frequently with a view to mystify it, to enable the patentee to keep his invention from the public; but I must add, that in many instances that which is new cannot be adequately described, unless you also describe something that is to be used with it; in that case the man ought to describe what he has inserted for the purpose of elucidation.

Are there not things occasionally put in that are known to be useless, for the purpose of mystification?—I have no doubt of it.

Mr. William Newton, called in; and Examined.

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WHAT is your profession?—I am a patent agent, and machine draftsman.

Do you conceive that much inconvenience arises to a patentee, from the length of time that elapses between his application for a patent, and obtaining the Great Seal to it?—There are many inconveniences arise from that circumstance; frequently his invention is superseded; that happens from various causes; one cause I consider to be the irregularity with which the documents are delivered from the Secretary of State's Office. I have frequently known that those papers which have been sent first, have been delivered last; that many boxes of papers have been sent to the King, and retained for weeks together; and I have known instances in which the warrants and the bills have been kept for some months under peculiar circumstances, His Majesty either being indisposed or greatly occupied, I presume, with other business. During the whole of that time the patent is stationary, and the patentee has no protection till the Great Seal is appended to the patent.

What is the usual time that elapses before the patent is sealed?—I can scarcely state any usual time for the delivery of the papers from the King; we begin to look for them after a week, but it is very seldom that we get them so soon. I refer to the two stages of the patent, the King's warrant, and His sign manual to the bill. There is another thing which is productive of inconvenience, which is the repeated journeys that the agent's clerk has to those offices, which induce him frequently to stay away three or four days, not apprehending that anything will be ready, and some other agents perhaps, more vigilant than himself, get their papers forward; and I have known instances in which patents have jumped one over another, to the prejudice of the first applicant.

How would you propose to secure the patentee from piracy during the time between his first application and the sealing of the patent?—I think it would be very desirable to append a sort of specification to his petition, in the first instance; and that from the date of presenting that petition he should have the priority of right.

Then you would not have him apply till he had matured his invention?—I think it is very objectionable that a man should apply for a patent upon a vague idea, which he has not at all matured. It is frequently the case, that he has to make out an invention about the time that his specification is due; in fact, in many instances the subject is not absolutely invented till within a day or two before the enrolment of the specification.

Does not that happen from the circumstance that the inventor is afraid of being forestalled?—Frequently so; I have known many instances in my own practice, of an inventor declining to pursue any experiments, and waiting till the last moment, till

till another person has specified an invention bearing a similar title. In one instance I travelled from Nottingham to London on purpose to see a specification that was inrolled on a certain day, not daring to inrol the specification I was engaged upon, till we had seen which had precedency. Ours was due the next day.

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Is not a patent frequently vitiated by the disclosures of workmen?—If the workmen are not faithful to their employer, it is; but the mere exposure to workmen, I consider to be experimenting, and in consequence would not vitiate the patent; but advantages may be taken by workmen, and the thing may be communicated elsewhere, and in some cases that has been done, and the invention publicly used, before the Great Seal was appended, so as to destroy the patent.

How would you remedy that?—By the mode which I proposed, that when you present your petition, you shall deposit a specification incorporating the leading features of your object, what one may call the principles, sufficient to render it obvious that you have a certain intention, that you mean to do so and so.

Do you conceive there would be any difficulty, when the inventor afterwards proceeded to give in his perfect specification, in identifying the thing which he should then describe with the original draft of it?—I should think if there was any mode of examining and approving this ultimate specification, the correspondence of the two would be evident, and it should be altogether rejected if it was not upon the principles of the former one.

Do not you think there would be great difficulty in identifying the description given in the last specification with the original draft?—That would depend upon the pursuits of the persons to whom it was submitted; a board constituted of gentlemen versed in mechanical matters, would see at once whether the second specification followed entirely the principles set forth in the first.

Would it not be very easy, in the first instance, to give in so general a description as to include a vast variety of particular descriptions that might be suggested by him afterwards?—It would be possible to do so, but I should think such a specification would be rejected at once as not conveying suitable information to grant a patent upon.

Then you would propose that the specification, in the first instance, should be precise?—Yes; I think it should be a preliminary specification, such as I have myself tendered to the French government.

Are you acquainted with the French law of patents?—I am tolerably well acquainted with the progress of patents in France.

Will you state what is the course of proceeding in France, on applying for a patent?—The course of proceeding in France is to deposit the specification with the petition and other papers called the *Procès Verbal*, which immediately upon depositing you take a certificate for; you then pay one half of the government charges, which vary according to the length of time for which you solicit your patent; you immediately take the certificate and get it inrolled, for which you pay a small sum, and that gives your patent precedency of all others that shall follow, even if another for the same subject came in the course of an hour; and that is the reason why it has been deemed expedient sometimes to deposit a preliminary specification which shall not contain all the particulars that might be ultimately called for.

How soon is the party obliged to put in his ultimate specification in France?—It is possible that they would grant the patent upon that preliminary specification, if he did not take care to have a better one inserted, but if the consultive board, upon opening those papers, which are all sealed till they come before them, find that the specification is not satisfactory, they call for further information, and then a more perfect specification is delivered.

When you say if the specification is not satisfactory, do you mean, if it is not sufficient to describe the invention?—Exactly.

Is there any examination, by scientific persons, of the specification, with a view of ascertaining whether it gives a correct description of the invention?—There is an examination before scientific persons, who constitute what are called The Consultive Board, and that examination has several objects, perhaps not the primary one of observing whether the specification is full and complete; but one object is to ascertain whether the invention is original so far as they know. If it has been published in any printed book, they will refuse the grant, and on refusing the grant will return the fees paid.

Does not the other point come under their consideration?—It does certainly; but I should suppose where there may be many patents, that point would be very likely to

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be slighted; because sometimes I have myself inrolled a specification that has contained a very long account of a very elaborate machine, and a great many drawings; and it would be very difficult for gentlemen to sit over those drawings and consider all the bearings of the different pieces of the mechanism connected with it; and therefore, I think, they would take it for granted that it is a correct description; it appears to be clearly described, and accordingly take it to be a good specification.

Are patents in France ever set aside after they have been granted, on the ground that the description is not sufficient?—I am not aware, but I should think it could not be so; because in France, a patent is open to have all improvements added and all amendments made during the whole period, upon paying a small fee; and perhaps a year or two after, when an inventor has made a sufficient number of experiments, he applies for a patent of *Perfectionment*, as they call it, and then he inrols his amended specification, and whatever the consultive board approves of, as falling within the range of the first claim and entirely belonging to it, they grant as part of the original patent, on paying a trifling fee.

Do you think that would be an improvement in the practice in England?—I think it would be highly desirable in England; because I have known many instances in which the patentee, not being able to pursue his experiments and construct his machinery before the inrolment of his specification, has ultimately found that he was deficient in parts, and has been obliged to go through the whole process of obtaining patents for the three kingdoms again.

Would you enable him, by application to the Patent Office, to add his new discovery to his former patent?—Certainly, I would.

And would you have it concurrent with the existing patent?—Yes; I will state an instance in point. A gentleman in Birmingham, has lately invented a very ingenious machine, for the manufacture of silk buttons, composed of course of many movements and parts; and one part of the process was to introduce small discs through a little opening like the opening through which you would push a letter into a box; he has now, half a year after the inrolment of his specification, discovered a mode of introducing slips of metal, which he can cut off in this machine without the difficulty of feeding in the discs, by hand, for which he has now been obliged to take another patent, which is not yet specified; and he is paying all the English fees again. It happened that he was enabled to put in an account of this invention into his Scotch patent; and his Irish patent, from the tediousness of the process of obtaining it, has not yet been granted; and therefore he will be enabled to incorporate both in one there.

With respect to the commission for the examination of patents in France, do you know how the board is constituted?—I believe, by appointment of the government; but that I am not positive of; I know that Monsieur Dupin, who is a well known philosopher, is a member of the board, because I have corresponded with him upon some points connected with the practice of the board.

Do you know whether the decisions of that board have been generally satisfactory to parties applying for patents, as well as the public?—I believe, they put the most liberal construction upon things, and they grant the patent stately at the risk of the applicant, not holding themselves answerable for his representation.

Have you heard that any complaints have been made of partiality?—No; I think they would not be partial; there are too many of them to suppose that there could be any connivance that would be unhandsome; and I am not aware of there having been any complaints that were worth considering.

Do you consider that a board of that kind would be beneficial in this country?—I think it would, if composed of gentlemen who are not actually manufacturers or operative engineers; but who have been, and who are well acquainted with scientific matters.

Are there any French patents set aside on account of insufficiency in the description of the invention?—I should apprehend very few, in consequence of the ease with which a defect of that sort might be amended.

Supposing an insufficient description is given purposely, with a view of misleading the public, how is it likely to be amended?—Then I conceive that the parties could only maintain that as the matter of their invention which they have described. If they have described a great many other things which are of no use, or that are not new, that does not as in England affect the validity of the patent. If there are twenty things claimed in the patent, and nineteen of them should turn out to be old, the

the twentieth still stands its ground without overturning the patent, which I think would be exceedingly desirable here.

Is it not the practice in some instances in France that the specification should be concealed?—I am not positive upon that point, it is an expensive thing to gain access to a specification, but I have seen specifications through my agent, who has taken me to the office.

What is the expense of inspecting a specification?—Perhaps two or three pounds.

But you are not aware of any case in which the specification of a patent has been entirely concealed from the public?—I think I have heard of such things, but I am not competent to speak to the fact.

Do you think it is a common practice?—No, I should think not, as a number of the specifications of French inventions are published by the Society at Paris for the Encouragement of Arts.

Then the moment a man has made an application for a patent, his invention is secured to him?—He secures whatever the board chooses ultimately to grant to him from that moment.

Is there any precautionary step that a person can take in France before his views are completely matured, in order to secure priority?—Nothing whatever, but the preliminary specification which I have described.

Then he must in fact have gone through probably, in most cases, a course of experiments before he can put in a specification?—He must absolutely have accomplished something that looks like an invention on paper.

Do you think it would be expedient to amend the law in this country so as to make it similar to that of France in that respect?—I think it would.

Is it not generally understood that the French specifications are concealed?—I do not know what may be the common understanding; I know it is not the fact. I believe the specifications are not shown but through a petition, and that causes the thing to be expensive.

Is the petition in most cases granted as of course?—I believe it is of course to a native, but not to a foreigner. I gained access to the specification of an invention which I was anxious to see, because the invention had been stolen from a printing machine which I sent over, and applied to another purpose (a power loom,) and therefore I was anxious to see it in order that I might stop the same thing happening here in England, which I did when a patent was applied for here, for the improved power loom.

In the case of a patent being infringed where the specification is concealed, how is satisfactory evidence given to the court as to what the original invention was?—I presume that the patentee produces his patent which has the copy of his specification appended to it regularly sealed and signed by the proper authorities.

In that case, does his specification at once become public?—I suppose it does.

In France, how many commissioners are there?—I do not know; there are, I think, ten or more.

Is it an answer to an objection against a patent in France, that the process has been examined by those commissioners, and that the patent has been granted accordingly?—The commission sit for the purpose of examining the petition and specification, and they report upon it; which report, if favourable, causes the patent to be issued; but if unfavourable, from a defective specification, generally calls for further information.

Supposing a patent is attacked in a court of justice, is it an answer to that attack, that the commissioners have investigated it and have granted the patent, and that therefore any objection to it is precluded?—No; I believe the commissioners do not take any such responsibility upon themselves, and I do not think it would be expedient that they should do so; I think that that which the commissioners do is tantamount to that which the Attorney General here ought to do; he reports that he has examined this subject, and thinks it will be for the benefit of the country that the King should grant the patent; whereas we all know that the Attorney General is otherwise occupied, and that he is not at all acquainted with any more than the petition.

Then you conceive it is no defence to the patentee himself, to say, this has been examined by the commission?—I think none at all; because, if it was, no patent could be overturned upon any grounds; for the commissioners having awarded the application, and a patent having been granted, would, upon those grounds, be established as a good one; whereas it frequently happens that, either because the

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thing has been used before, or has been published before, or upon some other ground, it is overturned.

Are patents ever overturned, upon the ground of their not being sufficiently described?—I think that never can be a ground, because it would be known in the progress of the investigation that such would be likely to be the ground of opposition to it, and the parties would take great care to amend it.

Is that the case in England?—No, it cannot be the case in England; because, in France, a specification is always open, to have a rider appended to it, which is a further explanation of the matter; but in England you cannot alter a single letter which you may even have inserted in error; I have lately been obliged to go over a patent again, in which there was an error of a single letter only; it was the word *pressing* instead of *dressings*; and I have been obliged to solicit the patent again.

What expense might that have put you to?—The principal fees and stamps being allowed, I should suppose it will ultimately cost thirty or forty pounds.

Do you happen to know whether it is a bar to taking out a patent in France, if they know that that patent is already in existence in another country?—No; that is not a barrier to taking out a patent in France; there is a condition that, when you take out a patent in France, you shall not take out a patent any where else, or, if you do, your patent in France is vitiated; the same happens in all the other Continental states, but that is got over with the greatest ease, because you employ your agent, or your brother, or your friend; and so an invention runs through all the countries, beginning in America and coming to England, then Scotland, then Ireland, then France, Holland, Prussia, Austria, and Russia; and that is the course they generally take all the way, under different names, beyond England, Scotland, and Ireland.

Before what tribunal is a patent defended, when it is infringed in France?—I have understood it is before the Court Royal.

Is it tried before a jury?—I believe it is; but I am not sufficiently acquainted with the proceedings to answer that question.

Is the question referred to the commission?—No, to the courts; I know that, because the courts have differed as to the interpretation of the laws of patents; the court, in one part of the country, has decided one way, and the court, in another part, has occasionally decided in another; for instance, it was first considered that the publication of an invention which should invalidate a patent, must be in the French language; it was afterwards determined that, if it was published in any other language, and produced in France, it would vitiate the patent, and it was ultimately asserted (but I do not know whether it was established as the law) that the mere enrolment of an invention in another country, where it was open to the examination of the world, was a publication.

What is your opinion of the protection afforded by a caveat?—It affords scarcely any protection at all; it merely gives the party notice when any one else is applying for a patent for any thing that involves even the same sort of expression in it; for instance, if a man was applying for a patent for an improved loom for the weaving of fabrics made of fibrous materials, and he were to lodge a caveat; if somebody else were to petition for a patent for preparing or spinning fibrous materials, it is a hundred to one but that the other party would have notice, upon the words fibrous materials, though the things are totally dissimilar even in their objects.

Have you ever known a petition for a patent successfully resisted, in consequence of notice which has been given?—Yes, frequently; I have opposed patents myself, and they have been stopped upon producing sufficient evidence to the Attorney General or to the Solicitor General that we were in possession of the same secret; they would of course refuse to grant a patent to the petitioning party, on the ground of the invention not being exclusively in the possession of the applicant.

Can you mention any cases in which a patent has actually been refused upon such a ground?—Yes; I remember a patent applied for by Mr. Dickenson, for metallic buoys: Mr. Stebbing, of the dock-yard at Portsmouth, had the same invention, and he opposed him; and the patent was refused by the Attorney General of that day.

At what time was that?—It was four or five years ago.

Is not a patent liable to be vitiated, if any part of what is claimed shall be proved to have been previously invented?—Yes; that is the misfortune of the existing practice in England; but I think it is extremely detrimental and hard.

What rule would you apply in such a case?—It arises out of the circumstance, that it is impossible for a person to know every thing that has been done, and therefore,

fore, through ignorance, claims that which has existed before; I should say, You cannot maintain this part of your invention; you cannot have an exclusive right to it; but do not let it interfere with the merits of other parts which are new combinations, unless it forms an essential feature of the invention.

What is your opinion of the present cost of obtaining patents?—I think it would be extremely desirable if it could by any means be reduced.

Are you aware of any case of rival patentees, in which one of the parties being unsuccessful has published the invention, and thereby prevented the other party from obtaining a patent?—I know such cases have existed, but I am not prepared to state the names, it is the natural consequence; I have known it often to have been threatened, that if such and such things are not done, I will immediately make public what I know of the matter; it has been done, perhaps, under circumstances rather of an aggravated nature, when parties have obtained the information surreptitiously, and have endeavoured to extort a something that they asked for: and I know that instances have occurred of floating caveats, for the purpose of picking up agency business, and getting a gratuity to suspend any further opposition.

Does that occasionally lead to compromise?—It has sometimes led to compromises of one sort or other.

What remedy do you propose for that?—The only remedy that I think can be proposed, is, depositing the specification at the time of the petition, and then allowing the parties to go into an investigation; in some of those instances, the opposing party had not the invention, but merely pretended to have something to annoy the other party; where two persons are really in possession of the fact, I should think that an application to the board, if a board is appointed, would naturally stop the progress of the patent, because it would be impossible to enter into the question how you became possessed of it, or whether it was your own invention.

To what extent would you think it desirable to reduce the expense of patents?—I can hardly say; but they are more expensive in this country than any where else.

Do you know what is the expense of a patent in France?—It depends upon the length of time for which it is granted; the patents are granted for five, for ten, and for fifteen years; the Government duty upon a five years patent is 300 francs, about 12*l.*, exclusive of other fees, inrolments and so on, which are trifling; for ten years, it is 800 francs, which is 32*l.*, and for fifteen years it is 1,500 francs, which is about 60*l.*

Do you approve of the plan of being able to apply for a patent for a shorter time than fourteen years?—I think it might be desirable, for there are many trifling things that pay the parties very well; little matters which they have suggested in the way of business, the stopper of a smelling bottle or some little thing of that sort, from the sale of which a great deal of profit has been derived; and I think fourteen years is too long to give security for such a thing.

Do you think that the great manufacturers would experience any inconvenience from the reduction of the expense of taking out patents, by their becoming exposed to frequent actions for making use of little trifling improvements for which people would take out patents, if the expense were materially reduced?—That will cure itself, because if those little improvements are worth adoption, they should pay the ingenious man who has invented them, and if not, they have no business to make use of them.

Is not one of the objections to the expensiveness of a patent, that it is an unequal tax upon inventions, the expense being nearly the same upon one which is of a very ephemeral nature, as upon one which may be in full use for fourteen years, and bring in a large sum?—Certainly, that is a reasonable ground of objection.

Do you think that the present cost is too much for a patent for fourteen years?—Yes, I think it is, because it is a tax upon ingenuity in any shape.

Do you think that any useful inventions are now lost, in consequence of the expense necessary for taking out a patent?—I am convinced there are many things lying dormant that will ultimately be lost, and many have been lost.

Do you think those are lost on account of the expense of taking out a patent, or on account of the uncertainty of the law if a patent is obtained?—Both; but the first consideration applies most immediately, because if a patent could be obtained at small cost, the uncertainty of the law in being unable to maintain it would be quite a secondary consideration, for they would only have lost the small sum they have paid.

Might not that operate also against the public, inasmuch as persons might be tempted to take out patents which they would afterwards not attempt even to main-

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tain in a court of law, merely for the sake of any short-lived advantage they might derive from it?—I do not think it would affect the public injuriously.

Are you aware of any patents that have been taken out where the invention has not been carried into effect?—A great many.

Is there at present any means of setting aside those patents?—There is not at present, but I think it would not be objectionable to provide means, for I know some very valuable inventions that, if they were in the hands of the public, would spread far and wide, and be very useful, but for some cause or other they are lying dormant.

Is the expense of maintaining a patent right in a court of law very considerable?—The expense arises generally from a cause that cannot very easily be remedied; it arises from the number of professional persons that must be brought from different parts of the kingdom to speak to the points under consideration.

Do you think the present tribunal is a satisfactory one?—No, I do not, for this reason among others, that there being no existing basis of law, the dictum of the judge is one thing one day and another thing another; and they frequently make up their minds before they have heard the whole story, or they are biassed by the respectability of some evidence, and so without intending it pronounce a judgment that is highly objectionable.

Have you ever considered any means by which that objection might be obviated?—I really do not consider that the judges are the most competent men to decide such points, and certainly juries are not the most competent men to consider them, because when a party of ten or a dozen of scientific men in court cannot make up their minds upon certain points, how is it likely that a jury of inexperienced men should even understand the question.

Do you not think, that from the nature of the thing, a patent must be a butt at which every body must be allowed to shoot?—No, I should think not, it has unfortunately been so frequently.

How would you remedy the present unfitness of the tribunal for trying patent rights, would you appoint any other?—That is a question that involves a great deal of consideration; I do not know how to reply immediately to it, without some reflection; but I think another tribunal might be appointed that should be more competent, subject to a further appeal to the courts above, if the decision was deemed unsatisfactory.

Do you think a commission, consisting partly of lawyers and partly of scientific men, would be more satisfactory?—I think it would, if composed of both lawyers and scientific men, but certainly not of one class alone.

Should that commission, in your opinion, be a permanent one, or one liable to be changed?—It should be, to a certain extent permanent, because the parties should not be so far subject to be shifted from their stations as to feel that their decision might be reversed by another board who might be appointed in their place.

If a commission of that sort were appointed, would you give parties who were tried before, it the right of challenge?—Certainly; I think that is a matter that we ought to insist upon as part of our liberties, because there might be instances in which a certain commissioner present might feel an interest. I have, in my recollection, one gentleman, who might very likely have been appointed upon such a commission; and who, in many instances would have been an exceedingly objectionable judge, a gentleman who is not now living.

Do you conceive, that if such a commission were appointed, the expenses you have spoken of as incurred now upon trials before juries, might be lessened?—Yes, I think they might, but at all events the decision would be more satisfactory, there would be fewer witnesses necessary, because there are many legal points which it would not be necessary to prove in the way they are proved in our present courts of law.

Is it not the fact that in France, persons having patents must work them within two years, or else forfeit the right?—Yes.

Do you think that lowering the fees considerably, would much increase the number of patents?—I think it would.

Do you think it would be desirable to have patents for all sorts of small improvements?—I do not see any difficulty on the subject that would arise, because if those improvements were to be so trifling as not to be worth notice, they would sink into insignificance; and if they were good for anything, the parties that introduced them would have a right to the benefit.

Do not you think that the existence of a great many small patents might operate as an impediment to the progress of other considerable improvements?—No, I do not.

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Might there not be patents taken out for very small things, which might be applicable to larger processes?—I think the majority of small things would be little shopkeepers' fancies, little things that they would imagine that, if they had the exclusive right of selling for five or ten years, they should get something by.

In the progress of manufactures, has not it frequently occurred that workmen have made some small discovery that has facilitated the progress of machinery very much?—Yes.

If patents had been granted in such cases, would it not very much have impeded the improvement of those great machines, inasmuch as it would be almost impossible to know whether they had been previously used or not?—No, I do not think it would, because they would soon be known, and the parties who wanted them, would purchase them.

Then you think that for any discovery, however small, made by a practical workman, a patent might be granted without incurring the risk of any considerable impediment being thereby given to the future progress of machinery, or art?—I should think, in a general point of view it could not be objectionable.

It has been stated to the Committee, that the cost of taking out a patent for fourteen years in England, Scotland, and Ireland, amounts to 350*l.*; how far do you think it desirable that that expense should be reduced?—There are several questions to be considered before that can be answered. I think, in the first instance, the cost of an English patent ought not to exceed 50*l.* or 60*l.* exclusive of what the patentee may have to lay out for drawings and description, which may be elaborate; then I think the patent for England ought to extend over the whole empire, and the colonies, if it is asked for; but then I do not know that it would be desirable, or that it would be necessary at least that a patent should extend over the whole empire at the same price, because there are persons interested in the procuring those patents in a variety of offices in Scotland and in Ireland, and unless some compensation could be made to them, I do not see that it would be quite correct to abolish them altogether.

Do you think that the whole cost of taking out a patent for England, Ireland, Scotland and the Colonies, should not exceed 50*l.* or 60*l.*?—I think that for England alone it should not exceed that sum, but I think where it is necessary to take it out for the three kingdoms, it might be fair to put on some additional fees, saving the government charges and the stamps; perhaps 20*l.* for each country, making the whole sum for the three kingdoms 100*l.*

Supposing you allowed a patent to be taken out for five years, what do you think should be the cost of that?—I should think that it would not be desirable to grant patents for the three kingdoms for five years, but if it were, perhaps I should say 60*l.* or for two of the kingdoms, 40*l.* or for one, 20*l.* I give this merely as my own opinion, and without having considered the subject.

Are patents granted to foreigners without being naturalized?—They must be resident. There has a question arisen, whether a foreigner who is not naturalized, can hold his patent; a patent also may be granted to any person who receives a communication from a foreigner, provided that foreigner is residing abroad.

Do you see any objection to the rule of law, that a man cannot obtain a patent in England for an invention that has been communicated to him by one of his own countrymen?—I think there are objections to that, but not very weighty objections, because if the original inventor is in being, he can generally take out the patent, and the other pay for it on his assigning it to him.

If any agreement of that sort was made between them, and it could be proved, would it destroy the patent?—It would, as the law now stands; but I think it would be desirable to correct that, and it would be also desirable I think to receive communications from natural-born British subjects resident in any part of the world; now we cannot take a patent for any thing that is sent here by one of our own countrymen; if my brother was in France, and there picked up a valuable invention and send it to me, I could not take a patent for it, but if he were to hand it to my agent, who is a Frenchman, and he were to send it to me, I could obtain a patent for it, because it would be a communication from a foreigner residing abroad.

Does not the communication of any particular, however minute, from a person residing in England, set aside the patent, however important the object of it may

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be?—It does, because it is no part of that subject which was sworn to in the affidavit appended to the petition.

Do you think the law could be amended in that respect?—I do not know that it should, because some evils have arisen to my knowledge from that circumstance; for instance, a gentleman takes out a patent for a certain improvement connected with the clarification of gas, and another individual has by some means become acquainted with an object of the same kind which another party had in view, and he acting dishonestly, goes and sells that invention to the party who has secured his patent, who gets it entered in his specification, and destroys the claim of him who is to come afterwards; that has occurred recently.

Is not it fair that any individual who has made a small discovery, should have the right of selling it?—Yes, but it is not fair that it should be included in a specification which is to be the echo of another man's affidavit.

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WILL you have the goodness to state to the Committee whether you have been considering any suggestions which have occurred to you for the improvement of the law with regard to patents?—With respect to the appointment of a consultive board, as it is called in France, it strikes me that it would be exceedingly desirable that such a board should be appointed to examine the petition and the specification; and I think it would be desirable that this board should have the power of saying for what period the patent should be granted.

Do you mean then, that the board should have the power of granting a patent for more than fourteen years?—I think it would be desirable that patents should be granted for various periods.

For more than fourteen years?—Under some circumstances. For instance, there are many trifling things, such as a patent for a new invented lace-hole for stays, a new invented fastener for gaiters, and such little matters as that, for which a patent should not be granted for more than five or seven years, in my opinion; but there are other matters of great magnitude, such as are connected with marine architecture, the construction of dams and fortifications, and things of considerable magnitude, which the inventors could not be remunerated for in the course of fourteen years. In that case, I should say the consultive board should have a right to grant a longer term; and, upon application, perhaps it would be desirable, where they saw a reasonable ground, that they should be able to extend the limits of the original grant.

Will you state to the Committee what you conceive to be such a publication as will prevent a person obtaining a patent?—It seems to me to be a subject not well defined; the patent states, "make, use, exercise and vend" the article; and upon that ground it is considered, that if any body has made, used, vended or exercised that thing before, that will prevent the patentee from enjoying the benefit of exclusive right to it. Now the publication of an invention in a book, is not either making, using, exercising or vending it.

Is it not notorious that the statement of an invention in a book would prevent a person obtaining a patent for it?—I believe it is the ordinary practice; but it does not seem to me to be decided; in fact, that has been a question lately raised.

Has not it been stated as a rule of law, that a person cannot have a patent for a principle found in a book of science?—It is very likely a rule of the courts; but I have not known an instance in which that has been acted upon; I should conceive it not a good patent, if the subject had appeared in print.

Suppose the invention was known to several persons, but had not been practised before the party applied for the patent?—Then, I think, the party might apply for a patent; being the first who communicated it to the world.

Did you ever know an application to the Attorney General for an invention that had appeared in a book?—The Attorney General would most likely know nothing of that fact; but if he had known that it had appeared in a book, he would very likely say, that the invention was published.

Do you know whether a communication to a servant in the course of an experiment, would be a publication?—Certainly not; nor to your friend whom you might show it to in confidence.

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Are you aware of an expression of Lord Eldon's, that if he was applying for a patent he would not communicate the secret to his own brother?—That I should consider to be exercising extreme caution, beyond what is absolutely necessary.

Are you not aware of several cases in which patents have been set aside, by persons to whom the inventions have been communicated having published those inventions fraudulently?—Yes, I am aware of that.

How do you reconcile that with what you have just stated?—The confidence was betrayed, and the person entrusted with the secret acted dishonourably.

Is not the law this, that communicating an experiment to a man who is necessary to the operation of that experiment, would not be a publication; but if that man told third parties, and they used it, that would become a publication?—Yes.

Can you mention any case at law bearing upon this point?—Yes, I remember that in the case of *Webster v. Euther*; it was attempted to be shown that a certain invention had been known before the date of Webster's patent, and they produced a tailor who had gone into the workshop to see his friend, one of the workmen, and had taken up a little implement that lay there, and asked what it was for; he was told that it was for a gun-lock; but the court ruled that that was not a publication of it. That trial took place three or four years ago.

On what ground was that held not to be a publication?—Because it was making by the work-people of Mr. Euther, privately; the patent was ultimately overturned upon another ground.

In what manner do you think the consultive board, as you have called it, should be constituted?—I should conceive that they ought to consist of lawyers and mechanics, but mechanics out of trade certainly; persons that should be fully competent to judge of the subject when placed before them; whether the specification was a fair description of the invention for which a patent was solicited.

What should be the powers which that Board should have, and what should be its object?—The first object should be to examine whether the specification ultimately delivered was the matter of fact sworn to, and generally described, in the first specification.

Would you require them to make experiments?—No, it would not be necessary; upon the comparison of the two specifications, it would appear whether they both contained the same subject, and gave a fair and clear description of the thing stated in the affidavit.

Would you give them the power of ascertaining whether the specification was a correct description of the invention?—I would not necessarily call upon them to take that pains; but if they thought proper to object to the specification upon any grounds, they should be at liberty to call the applicant, or his agent, to explain further.

Would you consider them responsible for the correctness of the specification?—Certainly not.

What would be the advantage of their examining it?—That there should be nothing fraudulent, that the patentee should actually specify the very invention which he had sworn to, not one which he had subsequently picked up; and I would make them responsible so far, but not responsible that it should be a perfect specification: they should look it over, and form a judgment whether it was a fair description.

How would they ascertain that it was not fraudulent, unless they examined it very carefully?—I think that might be done very readily.

In the case of a chemical discovery, how would they ascertain that the specification was accurate, without experiments?—That would be rather a peculiar case, because chemical theories are not so generally known as that a person could see at once the result of all combinations.

Are there many patents taken out for chemical inventions?—Comparatively very few; there is not, on an average, above one patent in a year for a medicine, and perhaps not above one or two in a year for dyeing; and those are nearly all the chemical patents that are taken.

With what powers would you invest the consultive board?—I think they ought to have the power of saying for what period the patent should be granted, according to their view of the value of the invention.

Would not you require that they should ascertain, very carefully, what the invention was?—Certainly; but I do not mean to hold them responsible for the specification being perfectly that which a competent mechanic might take in his hand and make the thing from.

Would not you make them responsible that the specification was a good one at least, before they issued the patent?—I should require them to look carefully into it, and if they objected to it, to call for further evidence.

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Would not the circumstance of its having been used, and not objected to, up to the time of the application for an extension, be a sufficient evidence of the goodness of that specification?—No, that would be no positive proof that the specification was an exact description of the thing; it should be incumbent on the board to know what the patent was that was intended, but they should not be bound to see that every part of the thing fitted and acted as it was described.

Have you had any experience in lawsuits for setting aside patents?—Yes.

What is the most frequent ground upon which patents are set aside?—The want of novelty in some part of the invention claimed in the specification; it is generally for some trifling fault in the specification; it is scarcely ever that the broad question is argued in court, I mean, by taking the whole plan before them, and seeing whether the invention is original; but it is more frequently overturned upon some little point, or upon some legal question; it is very seldom that the merits of the question are gone into in court; if there is any faulty point, they take hold of that first.

In other words you mean to state, that many a person who in fact deserves a patent for a meritorious invention, loses it for some trifling thing?—For some trifling thing which he has included ignorantly or incautiously.

Have not the courts of late, construed the specifications as liberally as possible?—Yes, they have lately taken rather too liberal a construction, and they have sometimes considered what the specification never intended; formerly the rule was quite the reverse; at one period the specification was subjected to every degree of severity; now the recent decisions have established the patent as claiming what the patentee never intended; I state that upon my own knowledge. I allude to the case of a machine for shearing cloth, in which a rotatory cutter is introduced, shearing from list to list; and it has been established by a recent decision of the court, that every patent containing a rotatory cutter, shearing from list to list, shall be an infringement of the first; now I take upon myself to say, that the patentees never intended to claim the rotatory cutter in every mode in which it could be applied to shearing from list to list, because one of the patentees has told me so; but the court has so ruled it, and as they said, for the purpose of supporting a valuable invention, which it was stated 100,000*l.* had been made from: but the fact is, that it has placed in jeopardy, if not destroyed, nine subsequent patents, all employing rotatory cutters, shearing from list to list, but actuated by different modifications of machinery.

Would not this evil be remedied by expunging from the patent whatever had been before invented, and retaining what is actually new?—It would be very desirable that if there should be nine parts or combinations or things in a patent proved to have been used before, and the tenth an original one, that the tenth should stand alone.

Supposing in a specification it should be clear that one part of it was old and others new, could the court, however they might wish it, support such a patent?—According to the present system of things, I believe they could not.

Have the courts ever gone that length?—They have not exactly gone that length.

If those other persons who have taken the rotatory shears had in their specification distinctly disclaimed all the parts that were invented before, and had taken only to themselves the portions that were absolutely new, would the court then have said that was an interference with the first patent?—In this case they took a very broad latitude for the import of the words “described method;” they considered that to mean the application of the rotatory cutter in all its ways; but the rotatory cutter is known to have existed before.

Do you think it would be expedient to amend the law so as to enable a person to take out a patent for an abstract principle?—I think not; I think a patent for an abstract principle could be of no use.

You stated that a patent should not be refused because some notice or hint of the invention had been given publicly before, but only on the ground of its being actually in use; do you propose that as part of the present law?—Yes.

Do you think that the patentee ought to be required to add at a future time any improvements that he may make to his original specification?—Certainly he ought to be at liberty to do it, if not required; he cannot very well be required; but if he fails to do it, he should lose the advantages of those improvements.

Is it ever considered in a court of law whether mistakes which may have arisen in a specification were unintentional; or is it taken for granted that any mistakes in the specification are fatal to the patent?—I have always found them fatal to the patent.

Do not you think that the intention of the party, in framing the specification, ought to be made a more prominent question in trials with respect to patents than it

it has hitherto been?—The intention ought to be considered, certainly; but it may sometimes be very difficult to get at the intention, because that may be concealed.

Do you conceive that any inconvenience arises from the present expense of taking out patents?—A very great inconvenience, and very great objection.

Do you see any way in which that expense might be lessened without inconvenience?—I think that if the government were to relinquish their charges, which would be nearly 60*l.* upon each patent, it would be a very great relief. That would leave all the officers in the possession of their fees. Whether it might be expedient to reduce any of the fees of the officers, is another consideration, on which I do not feel competent to speak; I should not like a patent to be a mere mercantile license; I think it still ought to be a grant from the King.

Do you think the evil you speak of would be removed by the reduction of the fees?—A great deal of the evil would be removed, because the expense of soliciting a patent, altogether amounting to more than 100*l.*, if 60*l.* was reduced from that, it would bring the sum down to about the price which I first considered would be acceptable.

With respect to a patent for Scotland and Ireland, would you leave the price as it is now?—No; I would include them in the same patent if it was desired, upon paying some of the fees that appertain to the officers.

That is to say, you would not wish the expense of a patent for Scotland, Ireland and England to exceed about 100*l.*?—No; but I think it would be desirable, if the three kingdoms were included in one patent, that the specifications should be deposited in the three metropolises, for the inspection of the public; because there is a great deal of advantage in exposing specifications; parties would be deterred from spending their time and money in pursuing the same objects, by seeing that specifications of the things already existed.

Mr. Charles Few, again called in; and Examined.

WILL you have the goodness to state any views which you have with respect either to the inconveniences of the present law, or any amendment which you think might be introduced?—The inconveniences I stated upon a former occasion, and in consequence of a question which the Committee put to me, I have turned my attention to the subject, and I have put down on paper a few suggestions, which I will read; they are founded upon the idea that the plan of a commission will be adopted. I would propose that the commission should consist of five persons; two to be selected for chemical knowledge, two for mechanical knowledge; one a barrister of years standing. The barrister is proposed from the practical knowledge he may be presumed to possess on questions of evidence, which must constantly arise between contending parties. The commissioners to be nominated by the Treasury or by the Lord Chancellor, or by the Chief Justice of the King's Bench, or the Attorney General; or by the heads of certain scientific institutions, *ex. gr.* Royal Society, Royal Institution, &c. &c. New commission every ten years: power of removal to be in the party nominating: commissioners not to be younger than thirty, nor older than fifty: commissioners to take an oath for impartially administering the powers delegated, and of secrecy. The patent right to be vested in the patentee or his nominee, from the date of his petition to the King. The affidavit and petition to be the same as now in use, excepting that the inventor may pray the grant to a nominee. The reference to be made to the Attorney General only. The Attorney General for the time being to appoint a clerk to the commissioners. Caveats to be entered with such clerk only. Notice to be given by him per post to each party, entering a caveat within four days after receipt of the reference of the petition to the Attorney General. Forty shillings to be paid annually by each person entering a caveat, and for each caveat. If no opposition to the application entered with the clerk within four weeks, the applicant to be entitled to perfect his patent. The party opposing, on entering the opposition, to deposit in the first instance 20*l.* with the clerk. The applicant to be thereupon called on to make a like deposit. If the opposition is successful, or the patent is not prosecuted, the deposit to be returned to the party entering the caveat; and the applicant to pay the costs out of the deposit made by him; if unsuccessful, the costs of the patentee, of the commissioners, and of the clerk to be paid, by the party entering the caveat, or so far as the deposit will extend; the residue, if any, to be returned. The commissioners for same purposes to be empowered to order further deposits by each. The fees to be payable to the commissioners for attend-

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ance, and to the clerk, (or a permanent salary to the latter) to be settled by the Attorney General. On a caveat or caveats being entered, the Attorney General to refer the same to three of the commissioners, of whom the barrister to be one, who are to examine the parties and their witnesses on oath, (if such commissioners deem it necessary,) and adopt such other means for satisfying their minds on the subject as they shall think expedient, and report the result, to the Attorney General, who thereupon shall give his fiat for granting or withholding the patent. If the three commissioners are not unanimous in opinion, then, on the same being notified to the Attorney General, the case to be re-heard before the five, and the decision of the majority to be final. Commissioners not to proceed on caveats until the four weeks allowed for entering same have expired. If either party prefer the hearing taking place before the five, such to be allowed, on the party requesting paying the fees of the additional two commissioners. If the patent is to issue, the clerk of the commissioners to receive from the patentee, on his bespeaking the patent, the sum of (being the amount of fees now payable at the different offices through which patents now pass; together with the amount of the stamp duty to be from time to time payable on obtaining patents; and the further sum of twenty guineas) in lieu of the ten guineas heretofore charged for soliciting a patent, which twenty guineas, and the forty shillings to be paid on entering a caveat, to be subject to the incidental expenses attending the execution of the commission; *ex. gr.* rent of rooms of chambers for carrying on the business of the commission, remuneration to commissioners, and such other charges, fees and disbursements as the Attorney General shall from time to time authorize; and the residue to be accounted for annually, and paid to the Treasury on the certificate of two of the commissioners, and on the oath of the clerk. All fees received to be paid into a banker's, to be nominated by the Attorney General for the time being, in the names of the five commissioners, and not drawn out but on the signature of three commissioners. The proportions payable at the different offices before enumerated, to be paid out of the general fund quarterly at each such office. The office for transacting the business of the commission to be open from 10 till 4 daily, (the usual holidays excepted,) and the caveat book to lie open to applicants for inspection during those hours on payment of one shilling for each search, the same to be accounted for as directed with respect to the other monies authorized to be received. If an applicant shall not bespeak his patent within four months after presenting his petition to the King, unless caveats are then under discussion, and in the latter event, not within one month after the same are disposed of, the right thereto under the petition presented to be forfeited. Parties to be at liberty to enter and proceed on caveats at any time before patent passes the Great Seal. All specifications to be inrolled (in the usual manner) within six months from the date of the original petition, or within two months after caveats are disallowed, in the option of the patentee, with the clerk to the commissioners; and parties to be at liberty to specify by model instead of or in conjunction with a written description. A patentee not to have any right of action for any piracy or supposed piracy of his invention which may take place between the time of his petitioning for the patent and the inrolment of his specification. A fee of one shilling to be paid on each search for a specification, and copy to be obtained at the expense of an applicant. A patentee to have liberty to present a petition to the Attorney General for leave to amend his specification, or inrol a further specification (before petition presented to recall his patent); and if the Attorney General shall see cause, from the circumstances stated, he may refer the propriety of permitting the same to such three of the commissioners as he shall think fit, and order and allow such amendments or further specification, if the three commissioners shall certify that in their judgment no fraud or concealment was intended by the patentee on inrolling the original specification; any person to have the power of questioning the patentee's right to the subject-matter of the addenda to the original specification, in the same manner as he may question the original grant. A patentee on inrolling specification of improvements adopted by him during the continuance of his patent, to be thenceforth entitled to the exclusive right to such improvements until the expiration of his original patent term; this permission not to preclude him from applying for a patent to secure such improvements as heretofore practised, if he shall prefer so doing. Any party to be at liberty to petition the King to recall letters patent, or to expunge matter introduced on an amended or further specification, stating therein the grounds on which the petition is founded; such petition to be referred through the Attorney General to the commissioners, who are to examine the parties and their witnesses on oath, and adopt such other methods

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as they may think proper for satisfying themselves on the propriety of recommending His Majesty to grant or refuse the prayer of such petition; and in case all the commissioners shall be in favour of granting the prayer of the petition, and shall certify the same to His Majesty, such patent or addenda, as the case may be, shall be void to all intents and purposes from the date of such certificate, and such certificate shall be filed with the clerk to the commissioners. If not unanimous, the party against whom the majority decides to have power of appeal by petition to the Lord Chancellor or to the King in council, or to the House of Lords; the appellant, with two sureties, to enter into a recognizance to the amount of for paying costs if awarded against him, or if he abandons his appeal. Evidence before commissioners to be reduced into writing, and either party to be allowed a certified copy on payment of 4*d.* per folio, and such sum for copy, plans, &c. as any two of the commissioners shall certify to be reasonable; no additional evidence to be allowed on appeal. The petitioner, to recall a patent, shall, on obtaining the reference to the commissioners, deposit with the clerk 200*l.*, the same to be applicable to the payment of the fees of the commissioners and clerk; and in the event of the prayer of the petition being rejected, to the costs of the patentee, such to be referred to the master of the court of King's Bench for taxation, by summary application to that court; if the prayer of the petition is complied with, the costs thereof and of the reference, including the fees retained by the commissioners, &c. out of the 200*l.* to be in like manner referred to the master of the court of King's Bench, and paid by the patentee, and the balance of the 200*l.* paid back to the petitioner; the commissioners to have power to call for a further deposit. The costs, in either event, to be recoverable by attachment or action on the master's allocatur.

Do you contemplate that the patent is to be kept secret?—Certainly not; I think the balance of fraud would be on the side of secrecy; I should think that the reason they are kept secret abroad is from a fear of other countries becoming possessed of the secret, rather than for the sake of protecting the patentee.

Do you propose that these commissioners are to judge of the correctness and propriety of granting the patent, and of the correctness of the specification, and that they are to be the court for trying the validity of the patent, when granted?—I think they should not have power to question the validity of a patent or specification, unless a caveat is entered, or subsequent petition presented to recall the letters patent; I think any person ought to be at liberty to take a patent out at his own risk, if not opposed.

You would have the commission sit in the place of the Attorney General?—Yes.

Do you propose to give the commissioners power to refuse a patent?—Only in case of opposition.

According to your plan, would you not allow any person, after the patent is once granted, to question the validity of that patent upon the merits of the case?—Yes, before the commissioners at any period; and if the commissioners were unanimous, then the patent to be set aside; if they are not unanimous, then a right of appeal to be given as before proposed.

If the power were granted of adding improvements to the patent during the continuance of it, you think there ought to be the same power of questioning the right of the patentee to those improvements, as in the case of granting a patent which is new altogether?—I think there ought, certainly, or else a great fraud might be practised by the patentee, stating in his original specification a portion only of his invention.

And might not a man insert the improvements of another in his own patent?—Certainly he might.

Do you not think the board of commissioners would be more efficient, if instead of being appointed for a number of years, there were a power to appoint special commissioners, or to add certain special commissioners, for the purpose of trying any particular case, with which the parties to be added might be considered as particularly conversant?—Yes; but there is great difficulty in saying who is to choose. To whom am I to apply for additional commissioners, and what is to be the ground of my application; a man might say, in every case, this is not quite the thing for a scientific man, or for a mechanical man, and who is to be the judge of that?

If power is given, in the first instance, to the Treasury, or to any other office presumed to be competent to appoint a board of commissioners, why might not the same power be given to the Treasury to add special commissioners?—Because they would not then have the labour of investigating, in the first instance, every case

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that came before them; and a commission is an expensive commodity; they would have to take every case on its own merits. A fraud might be committed by the patentee; he might misrepresent the specification of his invention, not liking the commissioners appointed, and stating that he should wish for commissioners of a certain class; believing that the existing commissioners would not view that as an invention which he thought proper so to designate.

What are the grounds upon which you would think that such a commission ought to set aside a patent if questioned?—Want of originality; previous use and practice; misdescription.

Upon which of the grounds enumerated by Doctor Brewster, in his article upon patents, contained in his Encyclopædia, do you think that a patent ought to be set aside by such a commission as you contemplate?—I include many of those in one answer—want of originality; that the invention was in use and practice prior to the grant; or that the patent cannot be worked by the language used in the specification, not being correctly described. I would not set it aside because the specification was so worded as to imply that the party had invented that which was old at the time. The present difficulty is this, that the person acting most *bonâ fide*, inadvertently describes in his specification (not thinking of it at the moment) some minute part of the process as his invention, which, in point of fact, was known before, or rather omitting to state it was known before, and because he does not state that he was only claiming so and so, his patent cannot be supported at law.

Do you contemplate that the commission is to see that the specification of the invention is full and complete before the granting of the patent?—No; a man should be at liberty to specify as briefly as he pleased, and the patent should be taken as valid until petitioned against.

Would it not be desirable that as those commissioners are fully to investigate the nature of the invention, they should exercise some discretion as to the specification, and should not grant the patent unless that specification were full and complete?—That would put the patentee to an unnecessary expense; he takes out his patent, and he puts in what he chooses to consider a proper specification, all at his own individual risk; he does injury to no one.

Is not the very ground upon which a patent is granted, an exchange of benefits between the public and the inventor, by which a monopoly is given to him for a certain number of years, in return for the advantage which the public derive from knowing the nature of the invention?—Yes; but the public have the means of referring to the specification, by which they may see whether or not he has dealt fairly by them, and his patent stands or falls by the result. There would be this mischief if the commissioners acted in the way suggested by the question, they could scarcely be expected to set aside their own specification; having by its allowance in a manner concluded the question; if afterwards an application was made to set aside the patent, they, having expressed an opinion in favour of the specification, would naturally be disposed to support it.

Do you contemplate that the commissioners should be empowered to direct, in the case of chemical inventions, the institution of experiments, for the purpose of seeing whether the process for which the patent was asked was correctly described?—Certainly not; it could not be expected that the commissioners would try by actual experiment every invention for which a patent was asked; for example, with regard to Sir Humphrey Davy's safety lamp, if a patent was taken out for an improvement in it, would commissioners trust to the petitioner's belief of its safety, and go down into a mine to see whether it did or did not answer? neither could a commissioner be expected to go down in a supposed improved diving bell, or to go out in an improved life-boat in a storm, to ascertain if it answered the purpose intended: and safety valves to air balloons upon a new principle may be invented; are the commissioners to make the experiment by ascending in the balloon? and so with respect to physic to be taken, and its operation to be attended to.

You have contemplated that patents should be granted either to inventors or their nominees; would it be desirable to restrict that provision to the nominees of inventors; are there not cases where the inventor may have died, in which it would be very desirable that not only the assigns, but also the heirs or representatives of the parties should be allowed to take out patents?—Certainly; what I meant by the nominee of a patentee was this, if a person brings me an invention, and says, this will answer, it is worth 2,000*l.* and I buy it of him, I propose that the patent should be granted to me, my executors, administrators and assigns, instead of to him, his executors, administrators or assigns.

What is the policy of restricting the taking out patents to parties receiving communications

munications from foreigners residing abroad?—I cannot see any policy in it; there is no reason why an Englishman inventing any thing abroad, and communicating it to one of his friends in this country, should not have the same benefit, and a patent issue on it, as in the case of a communication from a foreigner to the same individual.

Or an Englishman residing in England, if he does not fraudulently obtain possession of the secret?—Yes; but that could be obviated in the way I propose, by letting the patent go to the nominee of the person inventing; the patent might be taken out by the inventor or any person on his behalf.

On what terms would you give the party applying for a patent security from the moment of his application?—Upon his having sworn that he is the inventor; and that it is not in use or practice.

Would you require of him at the same time to lodge a specification of the invention?—No.

If another man should come in afterwards, how would you know that his mode was not the same, and as early invented by himself as that for which a patent had been applied for; but that he had not access to the Attorney General at the time to make his application?—The question of priority would be for the decision of the commissioners.

Would you allow a person between the application for a patent and the sealing of the patent, to make experiments without prejudice as to the possible publication of the invention?—Yes, I would; and I should consider his patent right secure after the expiration of the first month; being the time allowed for entering caveats.

Would not there be a danger that during the remaining five months, a person might insert in his patent the inventions of another party?—There would.

Then you would allow the validity of a patent to be questioned, upon the ground of his having availed himself of the discovery of another?—Yes; and I would allow the commissioners to decide on the question of fraud.

Suppose the inventor has not fraudulently discovered the invention of another, but that a third party during the interval of those five months, has hit upon the very same discovery, would you in that case allow the patent of the applicant to be questioned?—That is a very nice question, that I could not answer off-hand satisfactorily.

What is the state of the law at present, if in the interval between the application for a patent and the sealing of it, a second party makes the very same invention that the party applying for the patent has made?—If the fact was proved on the trial of a patent (but I do not know how it is to be done) that it was not the invention of the original patentee, of course he would lose his patent; the difficulty would be the proof of it.

It may be in use and practice secretly by another party, or it may be in use and practice openly; if in use and practice openly, it would doubtless vitiate the patent; but if in use and practice secretly, how does the law stand?—I think, as the law stands, that that would not be an use and practice. I think there was a case of some telescope that Dolland had invented, which he had kept in his own private chamber, and had only shown to a few friends, and that the court held that that was not an use and practice.

The Committee have been informed that a second party making a discovery, and using it secretly, would be allowed to continue that use for his own benefit; but that the patent of the first applicant would not on that ground be set aside, but would continue valid as regards all other parties?—I do not coincide with that opinion; I consider it not founded in law.

You propose that any petitioner opposing the grant of a patent, should be required to deposit 200 *l.*; would not that operate very unequally, would not that be very large in some cases and very small in others; and would not it tend to prevent attempts to oppose patents?—Not much, because the deposit is not necessarily an ultimate payment; the party is to have it back again in case of being successful, and the patentee is to pay the opposer's costs in case his patent is successfully resisted; but it is a very small sum I have proposed should be paid on entering a caveat.

Do you propose that the party should apply to the office and make an affidavit, and remain quietly for one month, to give the chance of another party coming, and that during that month it is to be concealed; or is the affidavit to be published to the world?—I would give no further publicity to it than the filing of it, because the opposing party is not ultimately injured, except by having to deposit two hundred pounds.

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What opportunity will the public have for opposing patents?—The same as at present; the moment they find the thing answer they will go and look at the specification.

What do you conceive to be the present state of the law, when between an application for a patent and the sealing of it a second person brings forward a similar invention to that for which a patent is claimed; are both parties in that case precluded from obtaining a patent?—I apprehend, in that case, the Attorney General would require affidavits to satisfy himself which of the two was the original inventor.

Supposing two persons came forward with the same invention, would he inquire into that fact then?—I apprehend he would.

Would not the second party bringing forward an invention to the Attorney General have to show that the thing was publicly known?—Yes, by affidavits.

Mercurii, 27^a die Maii, 1829.

Mr. Moses Poole, called in; and Examined.

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HAVE the goodness to state any views you have on the subject of patents?—I have no particular views; I do not see any defect in the present law; perhaps the specifications might be made more sure.

You have had considerable practice in the taking out of patents?—I have.

Can you state any inconveniences in the present law?—Not if it is properly followed up, I see none; the time of the King's signature being obtained is too long at present; I have known patents lost, from the length of time that has elapsed, the invention having been published through want of sufficient care in the inventor.

The length of time that has elapsed between the beginning of the patent and obtaining the seal?—Yes.

What length of time usually elapses?—It is from six weeks to four months, when the King has not signed regularly; I think the last time they were a month, or more, before Him for one signature.

You have said in consequence of such delay you have known patents to have been lost?—Yes, during the time of obtaining the patent.

Do you suppose that often happens?—It is sometimes the case; it is of uncommon occurrence.

During the whole of that time it is true, is it not, that the applicant for the patent has no protection?—None at all; I have known several instances where they have been lost in consequence. I remember a case of one in the time of Lord Eldon, when he was Attorney General, where the man invented improvements in spectacles; on the very Saturday before, he mentioned it to a person, who got them made and exposed for sale in the window on Monday as the patent was to have been sealed on Tuesday; the Attorney General, now Lord Eldon, then gave it as his opinion the patent was completely lost.

Has any remedy for that inconvenience ever occurred to you?—None.

What is the shortest time, even if there is no improper delay, by which you can obtain the sealing of a patent?—I once procured a patent in fourteen days for Sir William Congreve, the shortest time now I could say, would be six weeks; I think I could not say less; that is the shortest.

Is there any mode by any additional fees, or payment of any gratuity, by which the patent can be hastened?—Private seals help it; but usually the King's signature delays it much: it has been obtained in three days, and sometimes as many months when he is not well; when he is ill it has been a long time in signing, when he is well he sometimes signs twice a week.

Have you ever considered whether any remedy could be applied to that inconvenience?—I have found objections to every plan I have thought of: I have thought whether, if the patent was applied for, and the Attorney General or the officer appointed had notice sent to every post office in the country, either by paying an additional fee or something of that sort, and if that in one month no objection were made, the patentee should be safe within the month, but if an objection were made, he would still be safe from the date of his petition; he would be perfectly safe on inrolling a complete specification: he would be safe after the notice was given; I should consider that must be by a committee.

Are

Are you aware of the French law on that subject?—Yes, I have taken out many French patents.

Is it not the case in France, when the petition is presented, the applicant for the patent obtains a certificate, and from the moment he obtains that certificate he is safe from having his invention pirated?—He is safe, (it is supposed he is safe;) but another person may improve on his invention.

He has all the protection a patent would ever grant him?—Yes, if new, from the very moment of lodging his specification.

He is as safe from the moment he applies as he ever can be made?—Yes, precisely so.

Do you see any objection to introducing such a regulation in this country?—I do not; to the security commencing from the time of application.

Do you see any objection to the adoption of some arrangement by which a person applying for a patent should be secured from the moment of his application?—I see none.

What is the usual time that is given for inrolling a specification after the patent is claimed?—Sometimes two months; but six for England, if Ireland and Scotland are intended; Scotland alone has four.

Do you conceive there would be much difficulty in drawing a specification so as to secure the patent in a court of law?—I do; and I think there are few persons capable of it.

Can you at all point out to the Committee in what that difficulty consists?—In their describing what has been used before, that is one fatal ground; and not so fully describing and claiming that a workman could work from the description, are the two principal points.

Are not those objections easily obviated by accuracy in the description?—There are few persons who are capable of describing the invention, they not being acquainted with what has been done before.

May not a person, with due diligence, ascertain what has been done before?—It is a very difficult thing.

Is it true then, that, in point of fact, the greater number of patents are set aside from some imperfection in the description?—I think it is very often in consequence of the title not agreeing with the specification, as well as want of novelty and other causes.

Can you give the Committee any information on that point to illustrate that?—The title must cover the invention which they intended to take the patent out for; for example, suppose "certain improvements in a machine" was the title, and supposing it but to be only one improvement, that would be a ground of making the patent void, or the contrary; for what can a patent be granted? the law is very confined in that respect, it must be for a new manufacture.

Do the different Judges, who have decided on what is and what is not a manufacture, agree?—I do not think they have clearly defined it; but I am not prepared to state in what cases they have not.

Have you yourself been in the habit of drawing up specifications?—Never; it is too difficult a thing for me to undertake; I occasionally look them over.

There are a particular class of persons?—Those I have been in the habit of recommending are, Mr. Farey and professor Millington, Mr. Rotch and Mr. Gill and others. Some persons undertake them who have no ability for them, and many capable, decline drawing them.

Do you conceive those persons the best qualified to prepare specifications who are able to do so with certainty, that it shall be sufficient to support a patent in a court of law?—I do, but there is difficulty.

That is owing to the uncertainty of what is and what is not the law?—Yes.

Have you considered whether it would be desirable to have a commission who should examine the specification before it is inrolled, to ascertain whether it is a sufficient description of the invention?—It might be desirable to look into the specifications in that way.

Have you considered how such a commission could be formed; of whom it should consist?—I think of persons accustomed to the work; such as engineers, mechanics, and committees according to the invention, it should have suitable persons for each sort of patent.

Should you think it fair that it should be a permanent commission or a varying one, or one appointed for the time?—Perhaps a number for each invention; for mechanical and other purposes, a continued commission.

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You would allow their decisions to be final, as to the sufficiency of the description, or let it still be open in a court of law?—A desirable thing to attain would be to make it final; to give the patentee a security from their decision if it could possibly be obtained.

You conceive then their decision would be satisfactory to the public?—I do not know, I am sure, about that; scientific men vary in opinion on some cases.

Would you see any objection to such a commission?—Not for the specification after the patent is secured.

Do you see any objection to a commission, constituted in the way you mention, being authorized to decide finally on the sufficiency of such description?—None.

Can you give the Committee any information with respect to caveats?—Yes; it acts merely as a notice when entered, and on an application being made for a similar object; the party hears of it, and decides within seven days if he will oppose the invention being granted or not.

Do you conceive that gives any protection to the inventor?—It gives him half the invention if they are alike; if a caveat is entered and a person applies for a patent, if on examination they prove to be the same.

Have you ever had to prosecute a caveat before the Attorney General?—Nearly every week. I had two last Saturday; and I have appointments this week.

Does the Attorney General ever call in the assistance of a scientific person to assist him in his judgment?—I never knew it done.

Suppose the Attorney General is not himself acquainted with mechanics or chemistry, what means has he of deciding between the claim of the two?—They are generally very minute in the examination when they find any difficulty; they see the party time after time until they are quite acquainted with it. Sometimes they go in three or four times; sometimes they take a month to consider of it. I have one now which has been standing over three months.

During the time that the question is considering before the Attorney General, is the applicant for the patent secure?—No.

During all that time he is exposed to have his invention published?—Yes.

It is the practice, is it not, for many parties who have patents still to maintain a caveat?—I recommend them for all the fourteen years.

For what purpose?—To prevent others from taking the patent for the same object. If a person applies for a patent, the patentee has the option of sending the party applying to the Inrolment Office, where the specification is lodged, and desiring him to read over his specification.

Do you conceive there is any advantage in separating the grounds of the patent for England, Scotland and Ireland?—If a patent were to include the United Kingdom, I think there would be a great disadvantage to those inventors who are obliged to commit the making of models or drawings to others, as instances have occurred where the workman has either himself pirated the invention, or inadvertently or designedly made it known to others, in which case the only remedy open to the inventor is to make the best of his invention in the other two kingdoms, he having lost all his chance in the one where it has become published, prior to his having taken his patent.

Do you conceive there is any inconvenience, as to cost, in taking out the patent at present?—I do not think it is too dear.

What is the whole expense?—About 360*l.* the three kingdoms, if with a short specification, and no opposition.

What advantage do you conceive is derived to the public in making the price of the patent so high?—It prevents patents being taken out for too trifling objects.

What inconvenience do you think would result, if patents were to become more numerous, and they were to be taken out for trifling inventions?—It would be, I think, to the injury of the common tradesman. A patent is an exclusive right to the vending of a certain article, and of course the patentee has a privilege over the rest in the same trade; if he gets that privilege too cheap, it would be to the injury of other tradesmen in the same line.

If he makes a useful discovery, why should not he derive the benefit from it?—The privilege is so great, when the thing is worth any thing at all, he ought to pay for it.

Do you think where an invention was of trifling importance, it might be desirable to allow a person to take out a patent for a shorter period, say for five years?—

I should

I should say not; I have heard no objection to the term of fourteen years by any person.

Are there not many trifling inventions for which the term of fourteen years is too long?—I should think not.

Are you aware of the patent that was taken out for the kaleidoscope?—I am; that was lost, not in consequence of time, but in consequence of exposing it before the patent was sealed.

Would a patent for fourteen years for an invention of that sort be desirable?—I should see no objection to it.

Might not the inventor of it see an objection to taking out a patent for so long a period at the present expense; would not it have been much more convenient for the inventor to take out a patent for five years, at a less expense?—I think it might be so; but I think that most persons would rather pay a larger sum and have it for fourteen years, than pay a smaller sum and have it for five years.

If your objection to diminishing the expense is, that it would make the benefit derived from the patent more than commensurate to the expense of it, would not it in some degree be met by diminishing the advantage derived from it, which would be done by shortening the period for which the patent would last?—It might be.

What office do you hold in connection with patents?—I am a clerk in the Patent Office by the appointment of the Attorney General.

Is that appointment a permanent one?—It is considered so; I have a written appointment from the Attorney General; Sir Samuel Shepherd gave it me when my father died, who was in the office for thirty-six years before that period.

Are the specifications inrolled in that office?—They are not; there is the Inrolment Office, and the Rolls Chapel, and the Petty Bag Office for inrolling them.

What are the duties of the Patent Office?—The Attorney General receives the King's warrant, and prepares the bill for the patent, prepares the transcripts, and sends them on to the Signet Office and Privy Seal Office.

Have you the custody of any of the deeds?—Mr. Dealtry, who is clerk of the patents, keeps all the warrants for the Attorney General.

You are aware that the original specification is returned to the party after it has been copied and inrolled?—I am.

Can that original specification be made evidence in a court of law?—I apprehend not, for this reason, we have the specification out, and should there be any defect in it, the party might alter it, and say it was the correct state of it at first.

Do you see any objection to allowing the original specification to be made good evidence in a court of law, on proof that it had been verified with the inrolled specification?—I see none.

Can that be done at present?—No, it must be an official copy.

Does not that add, in some cases, considerably to the expense of a trial?—Much, where the drawings are expensive.

Do you know any cases in which the original rolls have been produced?—In any cases it is allowed, upon paying the clerk for carrying it up; I think it is two guineas.

Has not there been a rule lately made by the Master of the Rolls, that the original roll shall not be produced, except in very special cases?—It is always done by petition; I never knew it refused.

Do you believe the present practice to be, that the original roll is taken out of the Rolls Office and carried to Westminster Hall?—By the clerk who has the custody of it, upon petition to the Master of the Rolls to allow it.

Do you conceive that that permission is granted as a matter of course, or only under very special circumstances?—I have considered it a matter of course.

You are not aware then that a rule has been lately made by the Master of the Rolls, which forbids the removing of the rolls, except under very special circumstances?—I am not.

Do you not conceive that it is objectionable to remove the original records; are they not exposed to the danger of being lost or injured?—There is the chance of miscopying, and that I should think would be the principal ground of wishing the roll to be produced.

Must not any danger of miscopying be obviated by having the copy verified?—I think it would be.

Is not that always insisted upon?—The parties may examine it; but it is usually examined by the clerk and the parties that ingross it.

Do you see any objection to amending the law, so that a person should be

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enabled at once to take out a patent for the three kingdoms, at perhaps the same expense that he has now to pay for taking it out for England alone?—I see none; there would be this difficulty perhaps, that there are certain officers in the different countries that depend upon the progress of the patent for their emoluments; but that does not concern the patents themselves.

Is there much expense attending the inspection of specifications?—It is 1 s. if you know the date of it at the Inrolment Office, and 3 s. 6 d. at the Petty Bag and Rolls Chapel.

You are aware that in some of the public journals an account of the specifications is published?—I am.

Do you conceive that all the specifications are published in those journals?—I do not.

Do you conceive that it would be advantageous to have a complete list of those specifications published in any public journal or gazette?—I have never given that much thought; but I should think it would not be so desirable; it has been supposed to give those persons who are anxious to evade the patent an opportunity of doing so; there have been several high opinions against it; I think the late Lord Ellenborough was opposed to it, and Lord Eldon.

Do you see any inconvenience in the time that is now given for inrolling the specification?—None; the only one is keeping the public in a state of suspense for the time.

Do you conceive that two months is sufficient time?—It depends upon the extent of the invention; some require twelve months.

Can you suggest any improvement in the present practice?—Nothing, but that I think a patent should be quicker obtained, and the patentee secured from the commencement.

But you have no objection to the present expense?—No; I have known them to get 130,000 l. by a patent; they all run the risk of losing by it, and those who get so much, pay no more than those who lose by it.

You have stated that there is great uncertainty in obtaining a patent?—I have.

Have you considered any means of rendering them more secure?—I have not considered any other means, except that of making them safe on the first application, and that after that, unless it could be proved that the thing had been practised before, the patent should be valid.

Do you think it would be desirable, in case of a patent being contested, to give the Attorney General the power of calling in the assistance of some scientific man?—I think it would, if they were on oath, that they should take no advantage of the information communicated to them.

Have you ever been concerned in obtaining the extension of patent rights?—Never.

What is the longest term you have known given for putting in a specification?—I obtained fifteen months for Colonel D'Arcy some time ago, as the legatee of Mr. Broderick, for putting in a specification; we have had two years sometimes.

Is not that length of time very inconvenient?—It is to the public.

Have you ever known a patent lost, from a disclosure being made by the servants of the applicant who had been engaged in making experiments?—Not exactly.

Do you think it would be desirable to adopt the course which has been suggested, that upon an application made to the proper authorities, the discovery should be made secure to the applicant till the issue of his patent, but that at the issue of his patent it should contain a specification?—It might be desirable.

Do you see any objection to it, provided the property of the inventor in his discovery was secured to him in the interval between the application and the issue of the patent?—I see none; but I think there might be objections to it which I do not see at present; perhaps lodging a skeleton specification first, and then afterwards making it up, would be desirable.

The proposal which has been made is, that upon application for a patent, the applicant should give the principal points of his invention without describing it in detail, but sufficient to mark the particular character of his invention, and that he should be secured of the property to that invention in the interval between his application and the issue of his patent; and that before the issue of his patent he should prepare his specification?—I think it might be a good plan.

Can you furnish the Committee with a detailed statement of the expense incurred at each of the offices in taking out a patent?—I have prepared a statement of the expense, which I will deliver in.

[The witness delivered in the same, which was read, as follows:]

PATENT

PATENT FOR ENGLAND:

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	Secretary of State's	Reference	-	-	£. s. d.	£. s. d.
		Warrant	-	-	2 2 6	
		Bill	-	-	7 13 6	
			-	-	7 13 6	17 9 6
£. s. d.	Mr. Attorney General,	Report	-	-	4 4 -	
Stamps, 6 - -	D ^o - - - -	Bill	-	-	15 16 -	20 - -
	Signet Office	Fees	-	-	3 1 -	
		Gratuity	-	-	1 1 -	
		Office-keeper	-	-	- 5 -	4 7 -
	Privy Seal	Fees	-	-	2 16 -	
		Gratuity	-	-	1 1 -	
		Office-keeper	-	-	- 5 -	4 2 -
30 2 -	Great Seal Office	Fees	-	-	5 17 8	
		Stamps	-	-	30 2 -	
		Boxes	-	-	- 9 6	
		Gratuity	-	-	2 2 -	
		Hanaper	-	-	7 13 6	
		Deputy	-	-	- 10 6	
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		Sealers	-	-	- 10 6	
		Office-keeper	-	-	- 5 -	49 2 2
	Passing the Patent	-	-	-	- - -	10 10 -
	Letters, &c.	-	-	-	- - -	1 1 -
5 - -	Specification according to its length.					
Stamps, £.41 2 -					£.	106 11 8

SCOTCH PATENT:

	Secretary of State's	Reference	-	-	£. s. d.	£. s. d.
		Warrant	-	-	2 2 6	
		Stamp	-	-	15 7 -	
			-	-	1 10 -	18 19 6
£. s. d.	Lord Advocates	Report	-	-	- - -	4 4 -
Stamps, 1 10 -		Director	-	-	15 - -	
		Clerk	-	-	7 10 -	
		Translator	-	-	1 1 -	
		Director	-	-	1 1 -	
		Servant	-	-	- 2 6	
		Livery	-	-	- 3 7 $\frac{1}{2}$	
		Extra	-	-	- 2 6	25 - 7 $\frac{1}{2}$
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		Deputy	-	-	2 10 -	
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Mr.
Moses Poole.

IRISH PATENT:

27 May, 1829.	£. s. d.	Secretary of State's -	Reference -	£. s. d.	£. s. d.
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What is the additional expense of a patent for the colonies?—The expense for the colonies is about 5*l.* additional.

Have you ever been engaged in any law-suits for the maintenance of patents?—Never.

Do you know the grounds upon which they are usually set aside?—I have hardly ever been in court when they have been tried, but I have heard the reasons; they are generally for want of novelty, or else a bad title.

Mr. Joseph Merry, called in; and Examined.

Mr.
Joseph Merry.

YOU are a ribbon manufacturer at Coventry?—I am.

Have you any suggestions to offer to the Committee upon the subject of patents?—I am in possession of three patents; one of which I went to trial upon at Warwick, for an infringement, and I was nonsuited upon the specification, for want of the evidence of Mr. Parry, who is the officer that enrols the specification. I exhibited the specification in court; but had not the officer that enrolled it, to prove that it was the true specification, and therefore I was nonsuited. If that had not been the case I should not have succeeded; because the specification was not a good one; and I do not believe there is one in a thousand that is good.

Do you conceive that there is great difficulty in preparing a specification which is sufficient to maintain the patent?—I conceive it is almost impossible.

How does that difficulty arise?—From the difficulty of describing what a jury would consider correctly the nature of the improvement.

Do you conceive that a person who *bonâ fide* wishes to give the public a fair description, has great difficulty in doing so?—I believe it is impossible; I have got three, and I do not believe either of them is good; the last was drawn by Mr. Rotch.

Does the difficulty arise from the specification being drawn up before the machine is actually complete?—No; I think from the difficulty of describing it after it is complete.

In what does that difficulty consist?—They require the specification to be so very minute; for instance in the case when I went to trial, I had four boards, in which there were a great variety of holes; if there should be more holes in one board than the other, they would nonsuit me upon that, unless I had taken notice of that particular fact.

Do you mean to say that a trifling inaccuracy in some point, not important to the working of the invention, will avoid the patent?—Yes; a point not of the least importance.

Can you state whether a case of that sort would be left by the Judge to the jury, or whether he would decide upon it as a point of law?—I cannot answer that; I have a patent for making ribbon velvets, which has been locked up in my place for five years; the improvement is so great that I can make forty pieces of this article while any other person can make one. Here are two pieces of this article (*producing the same*) one of which is English manufacture, the other is German; the German cost three-pence a yard, and the English cost sixpence; and the German is very superior to the other in point of quality.

Was

Was your patent communicated from Germany?—It was obtained partly by information I have had derived from foreigners and partly from my own invention; I am entitled to a patent for any thing I bring into this country, whether I am the inventor of it or not.

Has that invention been infringed?—I have locked it up, and nobody can do it but myself.

Is your patent for an invention which is identical with the German process?—Yes.

Do you mean that you have not practised the invention?—Yes; because I cannot do it to a profit; because if I were to begin working it, all my neighbours would immediately do the same in defiance of my patent; the specification is not worth a farthing, and I do not believe it is possible to make a specification upon this loom, that will pass in a court of law.

Why not?—From the great difficulty in passing a court of law, and technicality required.

What induced you to take out a patent for this invention, if you have not used it?—It cost me three or four hundred pounds, and I saw the advantage of the thing; and when such a law shall be passed as will enable me to work it with advantage I will work it.

All that you require is a secure patent?—Yes; the patent holds out a security which it does not afford.

Do you mean to say, that if your specification was sufficient, the law would then not be adequate to your protection?—It might; but I do not mean to go to law again about a patent; I would sooner relinquish the patent altogether.

Must it not be necessary, under any system of patent law, to specify the invention?—I think not; I would not have any specification; I think it would be better to send the identical machine by which the thing has been effected, before a proper board, who should take cognizance of that machine; and I think if a man has really a new invention, the board ought to have an absolute power of preventing any one from using it for a certain time.

Are there not many inventions in which it would be impossible to lodge the machine itself?—I am not aware of any.

For example, chemical processes?—There it could not be done; but in this case, of mine it would be perfectly easy to send up a model, and the board would be able to decide whether any other was like it or not. I have another invention, which I think is deserving of a patent; it is a loom by which I can make six yards of ribbon in the same time in which one has ever been produced in England. Now I should be quite ready to give up the loom itself if I could obtain a secure patent for it.

Do not you think that there would be this objection to your plan, that if you lodge the model of the machine itself, the most trifling change in that machine subsequently would vitiate your claim to the invention?—I think the Board should have power to decide what was an infringement and what was not. I do not at all object to the present payment for a patent, if I can only obtain an effective security, and not merely a nominal one.

Supposing it were left at the option of an applicant to specify on paper, or to lodge a model of his invention, is it your opinion, that an applicant would generally prefer the lodging of a model, or would it not be too expensive?—I should think they would generally prefer the lodging a model; it is the only way in which any one can decide whether it is original or not.

What is your opinion with respect to the appointment of a scientific commission for the decision of disputes upon patents?—I think it would be very desirable.

Do you imagine, from what you know of the manufacturing community, that such scientific tribunal would be generally satisfactory, provided it was impartially appointed?—I should think so.

In the present state of the law, if a person has invented a new pattern of any silk or ribbon, can he protect it?—No; it would be very desirable that that should be done.

Has any means occurred to you by which that could be done?—By the same means by which it is done in France. I make a new pattern; I seal it up, and send it to the Chamber of Commerce in Lyons, and that pattern is not opened unless it is infringed upon: if I find any one infringes upon my pattern, I send him before the chamber, and they open the pattern to which I refer, and at once decide whether it is an infringement, or whether it is not an infringement upon that pattern;

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Joseph Merry.

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pattern; if it is an infringement, they condemn the loom and the work in it, at once.

How long would you require that protection to be given?—For a twelvemonth would be quite sufficient; but there is no limit to the time there, nor is it necessary, because the thing dies a natural death; for instance, a pattern which is fashionable now would not be so next year; a protection for the season would be quite sufficient. It frequently happens that patterns I have invented are exhibited to the public long before I get them out of my looms; and I do conceive, that unless some protection is afforded in that shape to the ribbon manufacturers, the trade must be lost to the country.

Do some manufacturers go to considerable expense in paying artists for devising patterns?—They have not; but they would do so if they were protected.

Do not they do so now in many parts of the silk trade?—In London, so far as regards the broad silk trade, I think it is done.

Is it not so in France very generally?—Yes, it is.

Would it be a convenience to manufacturers if they were allowed to take out short patents?—Yes, I think it would. I employ about five hundred people, and they are every one at play at this moment. This art of velvet weaving, for want of protection, is entirely lost to the public.

You propose that it should be left to the option of a person who had discovered a machine, to construct a model, and put that in some public office. Do you think it would not be possible, in the event of a person wishing to infringe the patent, to construct a machine on the same principle, but so different in its appearance, that no jury would be able to say whether the two were identically the same or not?—No, I do not think he could construct a machine that would do the same thing without infringing the principle.

Would the present tribunal afford you security in the event of your depositing a model?—I think it would.

It has been stated by many persons, that even where there are the most accurate drawings it is quite a matter of uncertainty how the jury will decide, because neither the counsel nor the jury are competent to decide whether the machine be new or not. To obviate that, you propose a model; might not the same objection apply to a model?—I do not think it could.

Would you recommend in that case, that the model should be locked up and kept from view, or that it should be open to inspection?—I think it should be kept for the inspection of the board alone. I think there is a great evil in specifications, because they are so easily sent out of the country. I believe any one can have a copy of the specification by paying for it, and therefore, an invention that we have here may be sent abroad with great ease.

With reference to the invention you have mentioned, the specification of which you have stated is insufficient, do you consider that if you were allowed you could so amend your specification of that invention as to make it available?—I do not think I could. I do not think I could make it so that a jury would pass it.

Do you conceive that many inventions are lost to the public from the unwillingness of parties to trust to the protection of a patent?—Unquestionably.

Should you be satisfied, if the law was so amended as to permit your lodging a model, to go now before a court and jury in case an attempt were made to infringe your patent?—I should be perfectly satisfied.

Mr. Samuel Morton, called in; and Examined.

Mr.
Samuel Morton.

HAVE you taken out any patents?—My brother Thomas Morton has, and I am connected with him in the patent; but they are in his name.

What are you?—I am a manufacturer of agricultural implements; my brother is a ship-builder, who invented an apparatus for hauling ships out of the water.

Can you speak as to the expense which is incurred in obtaining patents?—Yes; taking the three patents together for England, Ireland and Scotland, they cost about 450*l.* including agency.

Do you think that too high a price?—No, I cannot complain of the price, provided there were protection afforded.

Do you think that a patent when it is obtained, does not afford that protection which is desirable?—We have felt that.

Can you point out how it is that it fails to afford the protection which it professes to give?—It appeared that the publicity at least in our case was injurious, because the

the specification was laid before a scientific man in Glasgow, along with the plan of the apparatus, to see how the patent could be evaded.

Are you then in favour of having the specification concealed?—I should rather say so.

Have you found any difficulty in drawing the specifications for your patents?—We were obliged to apply to a gentleman in town, who is in the habit of drawing specifications, that it might be done correctly.

Was your patent infringed?—It was.

Did you maintain it afterwards in a court of law?—We did maintain it, but at very considerable expense; because as soon as the trial was ended, the parties failed, and we had the whole expense to pay ourselves, which was about 430*l*.

Have you been engaged in more than one trial?—Only one.

Have you any cause to complain of the difficulty of drawing a specification?—Not of drawing, but we ran the risk of losing the benefit of the patent altogether, if the jury had taken a different view from what they did.

You heard the suggestion made by the last witness, with respect to lodging a model of the invention in some office; would that in your opinion be desirable?—I should think it would be very desirable, if there were a board established, to have the invention submitted to that board.

Supposing the invention were decided to be entitled to a patent, do you think it would be desirable, in order to secure the property of that patent, that the inventor should have a power of lodging a model of his invention?—I think it would be desirable.

Do you think that many inventors would avail themselves of that law?—I think they would; and I believe the law requires it now.

If the model was to be deposited, would you not expect it to be an extremely well finished working model, upon due proportions, so that a person might ascertain minutely every thing that was necessary to make such another?—It would be necessary that it should be made upon an exact scale certainly.

Have you found any inconvenience in the rule of law which limits the granting of a patent to five persons?—At one time we did feel a little of it, because at one time it was suggested to throw the thing open to a joint stock company, but the law prevented our attempting such a thing.

Do you conceive that that limitation of the law prevents any inventions from being carried into effect?—I dare say it may when they are very expensive, but I do not know any instance of it.

Do you conceive that it would be a beneficial alteration of the law to allow patents to be granted for a shorter time at a small expense?—I should think that there ought to be different periods; there are some patents that come into operation immediately, and five years might be sufficient for them; those that take rather longer in coming into operation might perhaps last for ten years. In our case the article was a very expensive one, and half of the period was expired before we derived any benefit from it.

Have you formed any opinion as to the possible advantage of appointing a commission of scientific persons to assist in deciding disputes as to patents?—I should think it decidedly superior to a court of law.

From your knowledge of the manufacturing community, do you think there would be a disposition to acquiesce in the authority of such a tribunal?—I should rather think so, at least I am perfectly convinced myself that it would be advantageous.

You think there would not be jealousies sufficient to interfere with its beneficial operation?—I should hardly think that; but it is a mere matter of opinion.

At all events, do you imagine that it would be considered a better tribunal than that of a Judge and an ordinary jury?—I should think it very superior, because it very frequently happens that the jury who may have to decide upon the patent are incapable of following it; but a board of scientific gentlemen would be capable of following every part of it.

Do you think that a tribunal of that sort might be so appointed as to produce confidence in its impartiality?—I should think so, much greater confidence than there could be in any jury.

Do you think it would be beneficial that that commission should be composed of a set of persons always acting upon it, or that there should be some power of appointing special commissions according to the particular case?—I should be inclined to think that a fixed board would be best.

Do you conceive it would be possible to find a board possessed of such universal knowledge

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knowledge of art and science, as to be qualified to judge upon all questions that might be brought before them?—If the board was pretty extensive, I think it might be done; and they might have the power of calling in other persons to assist them in particular cases.

Have you any other suggestions to make?—With respect to the terms upon which patents are given, I conceive that fourteen years is quite insufficient in many cases, especially in such a case as ours, which is a patent for hauling ships out of the water, where the invention is very expensive. A slip for hauling out a vessel of 500 tons, may cost from 1,500*l.* to 2,000*l.*; and although the utility of the thing was perfectly apparent to the public, they hesitated before they adopted it; the consequence of which was, that we were obliged to lay the slips down at first at a loss, purely to introduce them; the consequence of which will be, that it will be impossible for us to be remunerated, unless an extension of the term can be allowed.

Have you applied to Parliament for an extension of the term?—No, we have not.

Have you an intention of doing so?—We have an intention to do so, unless this Committee shall make such an alteration of the law so as to make it unnecessary.

Do you feel any objection to going to Parliament for an extension?—It is attended with considerable expense; and it is doubtful, as the law stands now, whether it may be granted; although this invention may be taken up in a national point of view.

What would be the expense of obtaining an extension by means of Parliament?—I understand, four or five hundred pounds.

Would much of that expense be incurred in the uncertainty, whether you obtained the extension or not?—I believe so, but I cannot speak to that point.

To whom would you propose to give the power of extending the patent; if there was a board of commissioners, would you think them competent to determine it?—I should think that board the best possible tribunal, because they would know the merits of the invention; and they would know whether it deserved to be prolonged or not. The Board of Admiralty and the Navy Board approve highly of the invention, and they are likely to adopt it; and there is not an individual that has got one of them that does not admit that it has surpassed his expectations.

Have you experienced any inconvenience in the applications you have made for patents, from the delay which now occurs in the sealing of a patent?—We were very likely to suffer by that, because there was an attempted infringement of our patent before it was completed; the patent was delayed so long that the apparatus by which it was intended to infringe our patent was nearly finished; and it might have been finished in fourteen days more; from what cause the delay took place I do not know; I believe His Majesty was unwell, which prevented the patent being signed.

Then in that case, owing to a casualty over which you had no control, you were very nearly losing the benefit of the invention?—Yes.

In your applications for patents have you ever met with any opposition?—None.

Can you speak as to the degree of protection that is afforded by a caveat?—I suppose it is hardly any protection; I believe it often does harm.

Did you ever enter caveats?—We always did.

Have you ever received any notice in consequence?—Never.

Veneris, 29^o die Maii, 1829.

Mr. Samuel Clegg, called in; and Examined.

Mr.
Samuel Clegg.

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CAN you state whether there are any inconveniences attending the present state of the laws relating to patents?—There are inconveniences attending the present law; one great inconvenience, I think, arises where a person takes out a patent, not specifying at the time sufficiently explicitly what the patent is for, so that it keeps another person who may have invented something similar, completely out of the market till he lodges his specification; and perhaps just previously to his lodging the specification, some other person may take out a patent for a similar thing: for instance, upon the occasion of the last patent I took out for certain improvements in the construction of a steam engine, I had to wait six months, because a person had

had just previously taken out a patent for certain improvements in the steam engine, and I could not tell what those certain improvements were.

Would a general title of that sort preclude other persons from taking out a patent for any thing of the same sort?—Yes; at least it would not be safe to take out a patent till you knew what the other person had taken out his patent for.

In that case how long would you have to wait?—Till he puts in his specification; there is one person who has taken out a patent, who did not put in his specification for fifteen months.

Then during that time all patents for improvements on steam engines are in a certain sense precluded?—Yes.

Could not you, by communicating your plan to the Attorney General, ascertain whether it was the same or not?—I should not think it safe to do that; I should not like to communicate my plan to the Attorney General: if a person who is in the possession of the patent should by any means get hold of my idea, and find it better than his own, he is quite at liberty to lodge mine instead of his own.

Do you mean that, in point of fact, such a description made by a person who obtained fifteen months for putting in his specification, would prevent any other person from taking out a patent for any further improvement in the steam engine for fifteen months, unless he went to the Attorney General?—Yes; perhaps persons who do not understand the objects of the patent law, will lodge a patent before they make inquiries; but that is very impolitic.

Suppose you apply for a patent for an improvement in the steam engine, and another person, before you had inrolled your specification, applies for a patent also for an improvement in the steam engine, what would be the result; would the Attorney General refuse to grant that second patent?—No.

Might two persons at the same time be taking out patents for improvements in the steam engine?—Yes; the only consequence would be, that if the person who got the first patent had a longer time for lodging his specification than the second applicant, he might take advantage of the specification which the other had lodged.

Supposing the second applicant for a patent did not lodge his specification till after the first applicant had lodged his, would any inconvenience result to either party?—The second applicant would run the risk and expense of his patent for nothing. Supposing the first applicant has not lodged his specification, and the second one takes out a patent for the same thing without knowing it, he will be throwing his money away.

Would you think it desirable to oblige persons to intitule their patents in a more particular and detailed manner?—Certainly.

Can you give an example how the person that prevented you from taking out your patent ought fairly to have intituled his?—If he had stated that it was a patent for a rotative piston, then I should have proceeded with my patent, because mine was not a patent for a rotative piston. If a person mentions what the construction, or what the part is, then it does not interfere with other patents.

Is not the reason that people give their titles so vaguely, on purpose to remedy that evil of which you just now complained; namely, that the second person shall not discover what the first is doing, until the first has an opportunity himself of specifying it?—A person coming afterwards could not avail himself of it, because his patent would be of a subsequent date.

Then what is the reason, in your opinion, that people express themselves so vaguely in their title?—To give them a large field of speculation. I have known people to take out a patent for improvements; not having defined exactly what those improvements should be, they have got an idea which is not at all distinct, and during the time allowed for specifying, if they can meet with any thing better than their own ideas they will lodge it frequently. When they know that a person is engaged with some improvements in the steam engine, they will often take out a patent for improvements in the steam engine, under the notion of getting hold of this person's idea.

Supposing you had conceived an improvement in a certain part of the steam engine, and a person had lodged a caveat, and you went for your patent, and stated the particular portion of the steam engine upon which you were so going to make an improvement, should you not be afraid, with the ingenuity that you know there is in every part of the world, that some person might be induced to pursue the very same improvement that you yourself were doing, if he knew what the point

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was at which you were aiming?—If there were two applying at the same time, I should not specify what particular point mine was.

You say, the other patent was intituled, "For general Improvements in the Steam Engine;" and, in point of fact, it was for a rotative piston; what was your's?—Mine was a semi-rotative.

Were you prevented from proceeding immediately to take out your patent, in consequence of the largeness of the former title?—I was.

Did you proceed afterwards to take out that patent?—Yes, when the other was specified.

Then, in point of fact, you had a patent for your invention, which you were unable to pursue until the expiration of those fifteen months?—Yes.

Do you know any other similar case?—That has occurred to me twice; the other case was about 1806; I took out a patent for a rotative piston, it was called, "For Improvements in the Steam Engine," and I was hindered, at that time, from taking out the patent by some other titles of patents that were running.

Do you know what those other titles were?—It was for certain improvements in the construction of the engine.

Did that delay you in taking out your patent?—Yes, and I have known a great many other people make the same complaint; particularly in the case of patents for cotton machinery, for certain improvements in lace manufacture, and other machines of that kind.

Do you know other instances of the same kind?—No, I am not prepared at this moment with any other; but I know that there have been such instances; and I know that people are suffering inconvenience now from a person having fifteen months to specify under a vague title.

Do you consider that, in the present state of the law, there would be any inconvenience to inventors, if they were obliged to make the titles of their patents more distinct?—No, I do not think there would; I think it would be better.

You are aware that there is no protection to the inventor between the application for the patent and the sealing of it?—No.

During the time, do you think that a more precise title would expose him to a risk?—No, I do not think it would; for instance, if I had a peculiar plan of making a metallic piston, that should serve without packing, I could safely say, that I would take out a patent for an improvement in the piston, and whoever contrived any improvement in the piston, of course would not specify that particular part till mine was specified.

Would you have no apprehension, that when the attention of ingenious persons was turned to the subject you were engaged in they might anticipate you?—Not at all.

Would you think it an improvement in the law, if the inventor was made secure from the moment he applied for his patent?—Certainly.

In that case there could be no possible objection to requiring that he should give a very precise title to his patent?—None at all: the short time allowed for specifying is another great inconvenience; and if the first evil I have mentioned was remedied, by his being more specific in the title, there might be a longer time given to specify; for when you come to put the thing into practice, however perfect it may be in theory, it generally alters its features so completely, though perhaps precisely on the same principle, that it does not correspond with the original drawings lodged. A man can very seldom get a machine lodged in six months. Although my last patent has been specified nine or ten months, I have not had time to complete one machine.

You think if the title were made more particular, there would be no objection to giving a longer time to put in the specification?—Not the least.

Are there any other points upon which you have any suggestions to make?—I think, in many cases, the period of fourteen years is too short. For expensive machines or engines, such as steam engines, or complicated machinery in cotton-spinning or lace manufacture, and other things of that kind, I should think there ought to be a longer time granted, on the payment of a certain sum of money: perhaps five or six years may elapse before a person can get it into the market; and by the time he gets it into work, so as to be profitable, the time has nearly expired.

You are aware that patents are sometimes extended by Act of Parliament?—Yes, but very seldom; and it is difficult to obtain. The last but one that I had, I tried to get extended this session, but I could not do it.

—Are

Are there many patents in respect of which it would be just to extend the time beyond fourteen years?—I think so.

Do you mean to say, that there are many inventions that require more than fourteen years to make them profitable to the inventor?—Yes; I think there are some inventions that require that time to perfect the machine before it is turned out into the market.

Can you mention any instance of that sort?—Yes; my patent was for a gas-meter, which I invented about fourteen years ago, and I think ten years of the patent nearly expired, in which I expended some thousands of pounds, and scarcely got one into the market, and it is now getting generally used; and if the time could have been extended, it would have remunerated me for the expense, and I should have made a profit of it; but as it is, it is a loss to me.

You think there should be a power vested in some quarter or other to extend the duration of patents?—Yes, upon a proper application; saying that such a sum of money has been expended; and that the time that it has to run will not be sufficient to remunerate the expenses, and to make a profit.

Have you ever considered where that power could be lodged satisfactorily?—No.

To what do you attribute that delay in introducing it to general use?—When there is any thing new of that kind, where there has been nothing of the kind used before, prejudices and various causes arise to prevent its general introduction; one great question that is asked is, how long will it last, and it is only the lapse of a certain time that will answer that question satisfactorily.

What is the objection to the present mode of extending a patent by Act of Parliament; is it to the expense that you object, or to the difficulty of obtaining it?—To the difficulty of it, besides the expense. The extension of my patent was opposed by all the gas companies throughout the country almost; they thought they could get the thing cheaper if the patent was not renewed; and so, after a number of years, and the expenditure of a great deal of money in perfecting the machine, it is thrown open to the public without any remuneration to myself.

Can you state any other instances of patents for useful inventions by which the inventor has not been adequately remunerated within fourteen years?—There are many; there is Mr. Perkins's for instance; he has been the whole fourteen years making experiments with his contrivance of high pressure steam, and he has not brought it into the market yet.

Do you think it would be a convenience if persons were allowed to take out patents for short periods at a proportionably small expense?—Yes.

Do you conceive that the expense of taking out a patent now is any evil?—No, I think it would be better if it was more.

Have you ever had to defend one of your patents?—Yes.

Did you find much difficulty in maintaining that patent?—No, there was not much difficulty; the cause was tried in January last in the Court of King's Bench; it was for a gas-meter; there had been various infringements upon it, altering it in form, but completely adopting the original principle.

Is there much difficulty in preparing such a specification as will support a patent?—Not when it is a new principle; but if it is merely an alteration, or an improvement of the original patent, it is very difficult to specify so as to maintain the patent; it is scarcely safe for any person to take out a patent unless it is a new principle; it is very difficult to maintain a patent merely for a slight alteration of form; another alteration might perhaps produce the same effect, where there is no new principle.

Are not the greater number of patents for improvements?—The greater number are for alterations; in some cases merely altering to the eye.

Does not any alteration of machinery afford a subject for a patent?—If it produces much simplicity, or answers the same end with only a portion of the expense; but in all things of that kind it is easily specified; I am speaking now of cases of slight alteration.

Where the objects are slight alterations are they worthy of a patent?—No, I do not think they are; I think patents ought to be confined almost to cases where the principle can be clearly stated; two-thirds of the patents are for mere alterations which nobody would ever look at the specification of.

Are you aware of many patents being set aside on account of some defect in the specification?—Yes, there was one set aside some years ago at Chester, it was merely a mistake in the drawing; the draftsman had drawn the lever that worked a

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part of the machine to go through the wheel, and the wheel could not revolve with it; that was in a power loom.

Are not the greater number of defects in the specification defects as to the wording?—Yes.

Do you conceive that many specifications are purposely drawn defectively with the view of misleading the public?—I believe there are some drawn in that way, but I am not acquainted with any instances of that kind; I believe there are many specifications entered totally different from what the real thing is for which the patent was taken out.

Do you think the present tribunal, by which a patent is tried, is a satisfactory one?—I think patent property is very uncertain property at present.

What does that insecurity proceed from? Is it from the uncertainty of the law, the varying decisions of the Judges, or is it from the incompetency of a jury to decide upon such questions?—I think it is from the uncertainty of the laws. The expense of a trial is very great; and till it is tried once or twice, or perhaps three times, it is not sufficiently established to deter other people from infringing upon it, if it is any thing of moment.

Are you aware that the Judges differ very often in the construction of the law?—Yes; I think the present Lord Chief Justice is very favourable to the law of patents; and I think a patent is much more secure while he presides, than it was with his predecessors.

What reason have you for preferring the present Chief Justice to the former one?—He considers patent property more sacred, and that a slight alteration or a little technical difference should not set aside the patent.

On what grounds do you think the present charge for patents not too high?—If it is any thing worth taking a patent out for, I think the expense is no consideration, because half a year's profit would pay the expense of a patent.

If the price of patents was very much reduced, do you think that patents would be taken out for very minute details?—I think in that case the Patent Office would be so loaded that a person could hardly bend an iron in a particular shape without running the risk of infringing a patent.

Do not you think that the multiplication of patents to a great extent, would be a great impediment to improvements in machinery and in arts?—Yes.

Have you known any instances of patents for small things which have stood in the way of improvements in machinery?—I cannot call any to mind at present.

Are not workmen, and people of that description, constantly in the habit of making little observations and small improvements?—Yes; sometimes very important ones arise from the workmen. If a workman has discovered any thing of the kind, and finds it likely to be beneficial, there is no difficulty in procuring any one to join him in the expense of taking out a patent for it.

Do not you think that if it became a habit among that class of people to secure patent rights for those small discoveries at low rates, it would be very inconvenient?—I think very much so.

It has been stated, that the expense of taking out a patent for England, Scotland and Ireland is something between 300*l.* and 400*l.*; do you mean to apply your observation when you say, you think the expense is not too great to that rate of expense?—Yes.

You mean to say, that that is not too great an expense for a patent for the three kingdoms?—No; I should think it would be no worse if it was a little more; it bears no proportion to the expense of completing a machine, or of defending it when it is infringed.

Have you ever considered whether it would be convenient to inventors, if they were allowed to have their specifications sealed, and concealed from the public?—No, I think it would be an inconvenience; I think it would not be a proper thing towards those engaged in the same line; there may be things sealed that other persons may be pursuing with vigour and expense; I think after it is once secured, the more public it is made the better.

Supposing a person at Birmingham or Manchester is prosecuting an invention, what means has he of knowing whether any patent has been taken out upon the same subject?—By applying at the Patent Office for a list of the patents upon the same subject.

Do you conceive it would be any convenience if there were offices established in the different manufacturing districts in which copies of the specifications were lodged, so as to be accessible to the public?—It would be very useful; and it would be

be a great advantage if a specification could be got hold of with greater facility than it is in town: they are not sufficiently clearly registered to know what are taken out; some things are omitted.

Would a person wishing to inspect a specification which has been inrolled some years ago, be put to considerable expense?—Yes.

How would that expense arise?—Perhaps from being obliged to come up to town.

Supposing a party wants to know what patents have been taken out for improvements made in the steam engine in the last ten years, is there any index or list?—He must go to the Inrolment Office, and he must pay so much for every copy he looks at; if he knows the date of the patent, he will find it there by paying a shilling.

Is there any list kept of the patents, by which a person wishing to obtain the information alluded to could obtain it?—No, I do not know that there is any list that a person could look over; if he is not certain of the date, I think he would have great difficulty in finding the patent he is in search of.

Supposing a person engaged in an improvement on the steam engine wishes to see all the specifications that have been inrolled within the last ten years for improvements in the steam engine, how would he set about it?—He must go to the Inrolment Office, and ask for the specifications of steam engines for as many years as he pleases.

What would he have to pay for that?—He would have to pay a shilling for each.

Do you mean that the clerk at the Inrolment Office would at once put them into his hands without any further search?—Yes.

Is there a list kept?—The clerk keeps a list, and you ask for a patent of any date.

Are the patents upon different subjects classed?—Yes.

So that the public have in fact the means of obtaining that information?—Yes, those that live in London; but if a person living in the country wanted to know that, he would perhaps have difficulty in getting the information through his agent; he would very likely want to see what had been done in that line, and he could not get that information without a copy of the specification; and each specification would be attended with considerable expense; I believe copies of the specifications average about half-a-guinea, without the drawings.

Are there not lists of the specifications published in the different periodical works?—Yes; but they are not to be depended upon.

Do you conceive that there are many inventions lost to the public from persons being unwilling to take out patents for them owing to the uncertainty of the law?—I think there is no doubt about that.

Do you think there are many of importance lost?—I can scarcely say about that; they might have been of importance, if they had been pursued.

If a patent is not taken out for that reason, is not it generally because the invention is not very important?—No; I think it has arisen in a great measure from the uncertainty in the property of patents.

Have you not known instances in which inventors have endeavoured to practise their invention in secret, preferring the chance of being able to keep it concealed to incurring the protection which the patent now affords?—I believe there are some lines where that is done; for instance, in chemical compounds; I believe they find it much more secure to keep their mixture a secret, than to take out a patent for it; but in the case of machinery it cannot be kept secret.

Where is the classed list of patents to which you have referred to be found?—I believe at the Six Clerks Office.

Have you seen it?—No; but I have been frequently employed by correspondents in the country to apply at the office to look at such a specification, and I go in and ask for such a specification ten years back or twenty years back; and a very short time elapses before they bring it me.

Have you ever asked them, without referring to the particular year in which the specification was enrolled, to furnish you with a list of the patents upon any particular subject?—No; I never asked for that; I do not think they would furnish me with that.

Have you ever asked them to let you see the specifications upon any particular subject for a certain number of years?—Yes; when I have not been certain of the time, I have begun at a particular time, and looked them all through till I came to the one that I wanted.

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John Millington, Esquire, Professor of Mechanics in the Royal Institution of Great Britain, called in; and Examined.

YOU are a civil engineer?—I am.

Have you heard what the last witness stated with respect to the inconvenience arising from the generality of the titles of patents?—Yes, I have.

Do you agree with him?—Yes, I do agree with him in many particulars. The reason, in general, of taking so wide a title is, for the very purpose of protection, that other parties may not hit upon the same thing.

Do you think, in the present state of the law, it would be a hardship upon inventors if they were compelled to give a more particular title?—I think it would be advantageous. Whenever a title does come before the Attorney General or the Solicitor General, if it is at all vague, they will not permit it to pass.

How is it that so many vague titles pass?—Because there happens to be no objection made to them under caveat, or in any other way. I have acted for many years as agent in obtaining patents, as well as in drawing specifications, and in many instances I have known a title refused by the Attorney General, because it was too general. A short time ago Mr. Wollams applied for a patent for improvements in carriages; that was sent back again, because it did not state in what part of the carriage the improvement was to be.

If the inventor is obliged to state his invention very precisely in the title, is not he exposed to the chance of having the invention discovered before the sealing of the patent?—As the law now stands he is. I certainly think that it would be an advantage to the public, if security, in some way or other, could be obtained from the date of the first application.

Would you recommend, that the applicant for a patent should state very precisely what his invention was?—Perhaps not very precisely. I myself think that the French law of patents is very superior to ours, and there the process is to lodge the specification in the first instance, for which the heavy fees are paid; but then for a trifling fee of about thirty francs you may improve upon that which you have taken out in the first instance.

Is there any limitation of time within which that must be done?—No, provided it is within the term of the patent, which may be for five, or ten or fifteen years.

That is done without obtaining any extension of the term?—Yes, it is merely an improvement upon the first patent.

Supposing a person makes a great improvement upon his original invention, might he take out a new patent for that, or must he, of necessity, add it to his old patent as an improvement?—He can take a new patent, as in England, *for the improvement*, but not for the whole thing.

So that he has the choice, either of adding his improvement to the old patent for the remainder of the term, or of going to the expense of a fresh patent for the improvement only?—Yes.

Are you acquainted with the law of patents in France?—Not very minutely; but having been employed to obtain French patents, I have their code of laws at home at length, as well as those of most other countries.

Does the specification undergo much examination before the commissioners in France?—It does not appear to me to undergo any; because I have known them inrolled with imperfections, and they pass them without any difficulty.

After a specification has passed that commission in France, are the public at liberty to question it in a court of law upon any doubtful point?—They are precisely as in England; there is this difference, that in France the infringement of a patent is penal, which it is not here. In England it is a mere question of damages, but in France it is penal to evade a patent, provided it is proved to be an evasion, and the infringed articles are burnt by the hangman.

What is the penalty?—Imprisonment or fine; every thing is seized; it is considered as trenching upon a government right; and as a contempt of the Crown, rather than as a matter between the parties.

Supposing a patent is issued in France, and afterwards a small improvement is added to it by the same party, would it be good against a person making similar improvement at a subsequent time?—It would be good as to that improvement; but if an improvement was made which did not belong to the patentee, and he incorporated it with his original patent, and it afterwards did not appear to be his property, that would vitiate the whole patent.

Supposing

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Supposing a man takes out a patent in France, and afterwards adds a very extensive improvement to it, perhaps larger than the original invention, would it be protected?—It would; because it is then incorporated with the original invention.

So that the law of France goes to protect not only a little addition to the original patent, but a very extensive alteration of it?—Yes, it does.

Are you aware, whether or not the specifications are concealed in France from the public?—I should apprehend they are not, but I am not aware of that precisely.

Can you give the Committee any example of a patent in France which was originally taken out, and afterwards improved to a great extent?—No, I cannot; I have taken out many French patents; but I have not taken out an improvement upon any one that I have taken out.

The Committee have been informed, that in France a specification may, upon application to the Secretary of State, be concealed; are you aware that that is the fact?—I am not aware that it is. In England I believe they can only be concealed by application to Parliament, because there have been concealed specifications in England.

Are you aware, whether there is any office in France where you can go and inquire whether such and such a patent exists upon any particular subject?—I fancy there is, because I have made inquiries of my agent in France, and he has furnished me with the information; but whether he got it officially or by favour, I cannot say. With respect to the means of finding what has been patented before in this country, I apprehend that Mr. Clegg, the last witness, must have been under some misapprehension as to that; because there is no classed list of patents. They are merely inrolled by the name of the party, and there is not even an index of the inventions; but Mr. Poole, who is the deputy in the Patent Office, for his own amusement, and for the inspection of his employers and clients, has all the patents arranged in that form; but then that is not officially done, and it is of course liable to error.

Suppose a person is engaged in an invention, would not it be very desirable for him sometimes to be able to gain access to all the specifications upon that subject?—Certainly it would.

And in order to do that, it would be necessary to have some index?—I have, in my own instance on two occasions, had to make out lists at very great labour; I made one lately for Captain Ross, which he added to his account of Steam Navigation; he has got a list of all the patents that have been taken out for steam engines; I obtained for another party a list of all the patents for fire-places; but it is a thing of great labour, and it is very expensive; because there is not only the office-fee to be paid for the search, but it requires a person to give great attention in looking through the books.

Unless a person who is engaged in an invention has an opportunity of looking at all the previous specifications, is he not liable to take out a patent for something that has previously been patented?—I should say that nine-tenths of the patents which are taken out, are not for things that have been patented before, but for things that existed before. That arises from a want of knowledge in the parties; and that is perhaps one of the mischiefs that attend the sort of secrecy there is in taking out a patent, that many persons fancy they have made an invention, and when they bring it before the world, it appears to be a thing that existed before.

Do you conceive that it would be a great advantage to have a list of patents published?—I think a list arranged according to the inventions would be more essential than the list of names which is kept at the office; because now the only thing that is kept is a list of the names of the patentees.

Will you inform the Committee how you obtained this list of the patents, which you say you got for Captain Ross?—By going to the office and looking over the book, taking every patent as it occurred through a number of years, at a very considerable trouble.

Which office did you go to?—To the Inrolment Office in Chancery-lane, to the Petty Bag Office, and to the Rolls Chapel Office; and it is a great inconvenience that they are divided among three offices; because, if I want to find out the specification of a patent, which was taken out by A. B. on a particular day in a particular year, I may have to go to all the three offices before I find it.

Is it optional on the part of the patentee which of the offices he shall inrol at?—It is quite optional.

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What is the description of list or book that is kept at each of those offices?—At the Inrolment Office there is no particular book kept for patents for inventions; because memorials and a variety of deeds have to be entered at the same office, and they are all entered in common in the order in which they come in. The only facility that they give is, that they write the word Specification in rather larger letters; so that if you are looking for a patent, you jump from one specification to another.

Is there any index to the book?—There is an index, if you know the name of the inventor and the date; but the index is not always made up to the time of the search.

Is the practice the same at the other offices, or different?—It is nearly the same.

At the Petty Bag Office is not there a book simply for patents?—They have some other records there; but they have a book expressly for patents, which Mr. Abbott keeps; but I think that is not official.

What is entered in the book?—The name of the party, the date of the inrolment, and the title taken from the patent, whatever it may be, in one line or more, as the case may occur.

Would not it be very desirable to have a complete list made out of all the patents?—I think it would.

In making that search for Captain Ross, would not it have been a great convenience if you had had the list to which you have referred?—He had to pay me for doing it, and in that case he would have had nothing to do but to get the list; there is nothing to pay but a shilling for the search, and half-a-crown for reading a specification. You are not at any of those offices permitted to copy a single word: you may take as much as you can away in your head, and it is chiefly in that way that the statement is procured, which is inserted in the periodical publications; but if you wish to have an office copy, you must have it upon stamped paper, at I think six and eight-pence a folio; and I have had as much as fourteen or sixteen pounds to pay for an office copy, and I never knew any one under two guineas. A part of this expense arises from copying the drawings.

Is it not likely that the statement given in the periodical publications is very often incorrect?—It is very frequently incorrect.

What is the fee for a search for a specification?—At the Inrolment Office it is one shilling for the first year, and four-pence for every other year; at the other offices it is a shilling for any length of time you like to search, and half-a-crown at the whole of them for reading a specification; you pay half-a-crown for each specification you read over.

Then the search is not very expensive?—It is only expensive inasmuch as it wastes time, and if you are unacquainted with the name of the patentee and the date of the patent.

Is it the same with regard to searching for any other papers there?—Just the same; it applies to deeds and registers, because the same books contain many other things besides patents for inventions; there are offices, titles, appointments, and other things held by letters patent, and they are all inrolled together.

Have you any other observations to make with regard to the laws relating to patents?—It has always appeared to me that the great inconvenience attending the obtaining patents, was the necessity of preserving secrecy during the period of two, four or six months; and that you are likewise under the necessity, if you wish for a period of six months for inrolling your specification, of making an affidavit, that the consciences of some people do not exactly like, inasmuch as they have to swear that they have an intention of obtaining a patent for Ireland and Scotland, when perhaps they have no such intention, but they cannot get the six months without doing that.

Do you think that two months is too short a time?—That depends upon the nature of the invention.

Suppose a party shows reason to the Attorney General for an extension, does he not usually obtain an extension of the term?—Yes. Another great inconvenience is, the parties being obliged to attend personally to acknowledge their specification; it cannot be done at present by a power of attorney, or in any other way.

Cannot it be done by persons residing in the country, by going before a master extraordinary?—Yes; but an instance occurred to me with regard to Mr. Collier, who had to go to the continent, and he only arrived in town a few hours before the

time

time allowed for finishing his specification, otherwise his patent would have been lost.

Do you agree with what the last witness stated, that it would be very desirable that the applicant for a patent should be secure from the period of his first application?—I do.

Do you see any way in which the protection of patents afterwards could be improved, so as to give greater security than the law affords?—I do not see any way.

What is your opinion of the appointment of a commission for the decision of all questions relating to patents?—That was a favourite notion of mine some years ago. I thought that commissioners might be appointed from among the most eminent men in the country, in different branches; taking one set of men for chemistry, and another for mechanics, and another for agriculture, and so on; and that, instead of going through the present almost non-efficient process of petitioning the King through the Secretary of State, and then the King referring it to the Attorney General to report whether the patent is worthy to be passed, and his signing a warrant or certificate again, to say that it is worthy to be passed, I thought it ought to be referred to commissioners, and that those commissioners might be paid nearly in the manner of commissioners of bankrupts, no very large fee, but still enough to make the business worth their attention, and that they should declare whether the patent is fit to be passed or not. This would increase the expense of the patent; but it occurred to me that the stamp duty might be diminished, and that a greater revenue might be produced by a stamp duty on the articles sold, instead of upon the original patent; because as the matter now stands, whether a man does not make a penny by his patent, or whether he makes an immense fortune, the country gets no advantage; but, on the contrary, if any thing of an *ad valorem* duty could be devised, so that that man who made nothing by his patent, should merely have the expense of his patent, and he who made a large fortune by it, should contribute a portion of that fortune to the state, it might be advantageous; but there seems to be great doubt as to the possibility of obtaining commissioners, or of getting the duty performed in an efficient manner without partiality or prejudice.

With reference to the security of a patent after it is granted and specified, if there is great technicality connected with it, could not such a commission better decide whether there was an infringement upon it than a jury could do?—Most certainly.

Would it not be necessary to subject the evidence given before such commission to the same provisions of law, in case of false evidence being given, which apply to evidence given before a court of justice?—Certainly.

It has been stated, that a jury is very often a very incompetent tribunal to try patent rights, do you concur in that opinion?—I do, from very long experience.

Would you prefer a commission of persons who understood the nature of the invention?—I would.

From the incompetency of a jury, are not parties often put to great expense, in order to explain the nature of their invention?—No doubt they are; because it is customary in all patent trials that are of importance, to subpoena almost all the engineers in town, who attend at very considerable expense to the parties; and if the commissioners understood the thing, of course it would not require that explanation.

So that, supposing that tribunal were subjected to all the rules of the courts of law with regard to the truth of evidence, such a commission without a jury would be better than the present mode of trial before a judge and a jury?—I conceive it would be more advantageous to the patentee; he would have a greater chance of losing his patent if it did not deserve to stand, and a greater chance of maintaining it if it did.

In fact a dishonest man at present has a greater chance than he would under those circumstances?—Yes; and I think if the patent passed for the three kingdoms, instead of separately, it would be advantageous.

Do you think that the expense of a patent is any evil?—I do not think it is, provided the patent was a secure property; I think it is rather an advantage that a patent should not be too cheap; the world would be inundated with them if that were the case.

Do you think that every patent should be for all the three kingdoms at that expense?—No; but I think if a party chooses to pay more, and obtain a patent for the three kingdoms in the same manner as he now does for the Colonies, in which

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case I think it is six guineas or six pounds, without having to send to the East or West Indies, and I think as the King's prerogative extends over the three kingdoms, if the party were allowed to have a patent for the entire dominion, upon paying a less sum than that which is paid for the three kingdoms at present, it would be of great advantage.

Provided the law remains as at present, of the three kingdoms being distinct, do you think it would be an advantage, that whether the patentee went for one, or whether he went for the three kingdoms, he should have six months for putting in his specification?—Inasmuch as if you have six months you can specify on the following day if you think proper; I think it might be an advantage; but, on the other hand, it might delay other inventors, because that is the only inconvenience that attends the extensions of time for specifications.

As persons sometimes are induced to state what is not quite true for the sake of obtaining an extension of time, would it not be an advantage if the same time were given in each case?—I think it would.

Have you been much engaged in drawing specifications?—Yes, I have.

Do you conceive that from the uncertainty of the law at present, there is much difficulty in some cases in drawing specifications?—I conceive that there are but two difficulties attending the specification; the one is, not to describe that which is the property of the public before, and which requires a very general knowledge of what has existed; and the second is, to describe the thing so clearly, that every competent workman will be able to carry it into effect.

Are not there some cases in which hardly any skill on the part of the person who is employed, will enable him to draw a specification that will secure the patent?—No, I should almost say not, with the exception of the first point I have mentioned, which perhaps no human being can be supposed to possess, that is, a knowledge of every thing that has gone before.

From a review of the cases, with regard to patents, is it not manifest that the Judges have very materially differed in their opinions as to the construction of the law?—Certainly they have.

Taking that into consideration, how is it possible to draw a specification which you are quite sure will meet all possible objections?—It may not meet legal objections, because there is certainly some doubt as to the mode of defining what a principle really is, because it is held that a principle is not patentable.

Are there not many cases in which the Bench has differed as to the sufficiency of the specification?—There are, certainly; it depends, in some measure, upon the nature of the invention; because there are some inventions which it is almost impossible to divest from being principles.

Are there not many cases in which the patentee receives a sum of money from other parties for giving them a license to use the patent?—In many cases.

Have you ever known an instance in which a person who has held himself out as ready to license persons for the use of that patent, has refused to license individuals?—I have never heard an instance of the kind.

Do you consider that he is under any obligation to license all that apply, upon agreeing to his terms?—No, I do not conceive that he is; but I never knew an instance of a refusal.

Have you ever known persons who have obtained licenses for the use of a patent, to stipulate that the right of using the patent should not be granted to others?—Never. There is another difficulty which I have on the tapis at the present moment. As the law stands at present, it does not appear that there is any protection of patent property in the East India possessions; they do not appear to be included in the colonies; and I think ought to be included in the laws of the country. An employer of mine has made an important invention, which happened to be particularly useful in the East Indies; he has been offered a large sum of money for the use of it; he applied to me to take the opinion of counsel, as to whether the patent which he has for this invention for England and the colonies, extended to the East Indies; and the answer given by Mr. Serjeant Spankie was, that it did not extend to the East Indies, inasmuch as the East Indies were not colonies. I then applied to Sir James Scarlett, who was then Attorney General at the time, to ask, whether he would grant a new patent for the same thing, inserting the word "Dominions," or something which Mr. Serjeant Spankie had represented as the right word, in the patent; but he said he could not do it for want of precedent; and I then applied to the East India Directors, to know what their feeling on the subject was, and again laid the matter before Mr. Serjeant Spankie,

Spankie, who seemed to think, that if the patent was granted for England and the colonies, that it would cover India, provided it was recognized by the East India Directors; and the difficulty at present is, how it is to be recognized, which is, at present, about to be laid before Mr. Serjeant Bosanquet, the standing counsel of the East India Company. It was proposed to be done by an office-copy made here, and transmitted to their presidencies, because the invention is of so much importance that the expense is no object, and the party is very desirous of being protected in India as well as in England. It does not appear that any one before this gentleman has ever applied for a patent for India.

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It has been stated, that a patent taken out for the colonies, does not avail a party in those colonies that have legislatures of their own, unless it is recognized by those legislatures; does much inconvenience arise from that?—I never yet heard of a patent producing a sixpence in any of the colonies.

Are they often taken out for the colonies?—Very frequently. There is another inconvenience which sometimes occurs practically with regard to trials in court, which is, that the patentee prepares a specification in the nature of a deed on parchment that goes to the Inrolment Office, and is copied on to the long rolls; but the patentee himself has no opportunity of examining those rolls with his original specification; and although I have done it in many cases of importance, yet it is a matter of indulgence. Now it is the roll that can alone be brought forward as evidence in a court of justice; you cannot bring the original specification; and although they are copied as carefully as possible, still, as they are done by mere copying clerks, and perhaps the original is not very clear, I have in some instances seen rolls and office copies brought forward, which are quite unintelligible from misplaced or mis-spelt words, from the parties copying them not understanding technical phrases; and I think the patentee should be compelled, or at least ought to have the privilege of examining the roll after it has been copied.

Has there been any instance of a patent being set aside in consequence of such an error in the roll?—No; it has produced difficulty sometimes.

In case of such a thing having happened on a trial in a court of justice, has the court ever allowed the original specification to be brought?—Applications have been made to produce the original specification; but inasmuch as that is in the hands of the patentee, and of course subject to alteration, I have known it refused in court; because the patentee may have altered it while it was in his possession. I should wish to mention also, that there is a great delay in obtaining an Irish patent in almost all instances, which is very mischievous.

Mr. *Walter Henry Wyatt*, called in; and Examined.

HAVE you any observations to offer upon the subject of the patent laws?—The subject of patents is one which I have been intimately considering for many years; and my opinion is, that great inconvenience arises from the present mode of granting patents.

Mr.
W. H. Wyatt.

In what way have you been led to turn your attention to the subject of patents?—I am the editor and proprietor of the Repertory, a work which has been published for the last thirty years, in which verbatim copies of the specifications inrolled, are published. We get at them in two ways, either by paying for copies at the office, or by the loan or communication of the originals from the patentees themselves. That work contains many hundred copies of specifications the same as in the office; and also contains a list of every patent that has been obtained since the year 1795; and I have a private volume containing a list of every patent that has ever been obtained since the time of James II., in the order in which they have been obtained according to the dates, with an index to their names. The Repertory forms now a very voluminous publication, and is to be met with in a great many public libraries, and is consequently very easy of access to inventors; but inventors seldom are readers. In the year 1794, when the Repertory was first published, the number of patents in a year was about fifty odd; and it has subsequently increased to two or three hundred for England alone.

Do you know how many patents were obtained in the time of King James?—I believe one or two; there are very few patents till the year 1796. I believe public attention was then drawn to it from the publication of the Repertory, which then originated.

Has the number of patents increased of late years?—They increased during that period when every thing was alive, but at the present moment they have decreased

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very much; there are from five to a dozen in the course of a month only. On the first day of every month I publish a list of every patent that has been obtained during the preceding month.

Do you conceive that the granting of patents has tended to stimulate inventions much?—I conceive that it has not only done that, but that the system of patents has been a greater spur to the improvement of the arts and manufactures in this country, than any other system that could be adopted, for no sum of money will gratify an inventor; if it is indefinite, his expectations are very great.

Are you acquainted with the law of patents?—Not as a professional man.

Do you know whether it is a general complaint that the law is very uncertain?—I believe universally; there are great inconveniences from the present system. The first and most prominent is the system of caveats, which tends to mislead all uninformed inventors, I mean persons whose attention has not been directed to the law of patents. The first impression, and it is almost universal, is, that entering a caveat is obtaining a sort of little patent, and that they have all the benefits of a patent for the expense of entering a caveat, which is 20s. during the year, and persons under the fancied protection of that caveat, commit acts that render the patents afterwards of no effect.

Does not that arise from their not taking sufficient pains to inform themselves as to what the law is?—Certainly; but it is so universal, that I have never been able to see a cure for it.

In point of fact is a caveat of any great value?—A caveat is of value under certain circumstances and limitations; for instance, if a person contemplates taking out a patent for an invention which he has not perfected, it prevents another person from anticipating him, and thereby excluding him, because he has notice of the application; and if his invention be the same, he has an opportunity of participating in it by an arrangement between the parties. I have known where parties have claimed a patent, and been opposed by a caveat, that a compromise has taken place between the two applicants, so that both parties have participated in the patent jointly obtained.

In those cases do you conceive that both parties were in fact fairly entitled to a patent?—In some instances; but I have known instances where parties have fished out the information by means of their caveat, and have participated. I have known mischief arise from the different periods for inrolling specifications. A person who has a patent for an improvement on the steam engine or any other invention, will have perhaps six months to enrol his specification, and another person who takes out a patent immediately afterwards, may have only two months. Then the person who is compelled to enrol his specification in two months, has no protection against the man who has six months incorporating the invention which he has inrolled in his specification. By that course the person who took out the prior patent, may totally defeat the other.

As the patent takes effect from the date of the sealing, how can that happen?—Supposing a person takes out a patent on the first day of July for certain improvements, with a power to inrol his specification within six months, and another person obtains a patent on the second of July for the same object, as is very frequently the case, in the precise words with a power to inrol within two months, when his specification is inrolled, there is nothing to prevent the man who has six months, incorporating the one that has been inrolled within two months, if he is dishonest enough to do it.

Will not incorporating the substance of the other patent vitiate his own?—If you can prove that he has not invented it; but that is a negative which you cannot easily prove.

On that account it is presumed most parties take the longest period granted by law for inrolling their specification?—They do, for that and other reasons, and in doing that, no great expense is incurred, nor any perjury; because in preparing affidavits to obtain time, the words I have introduced are, "that the petitioner hath directed petitions to be presented to His Majesty, praying letters patent," but he does not go on to say that it is his intention to take out the letters patent. The affidavit used formerly to go on to say that it is the intention of the party to complete them.

Are there any means of ascertaining the nature of the caveats that take place in respect of patents?—With reference to the Attorney and Solicitor General, whose clerks keep lists.

What

What do you think of the policy of preventing a person taking out a patent for an invention discovered by a British subject, and permitting him to take out a patent for an invention communicated to him by a foreigner residing abroad?—I think the policy of permitting patents to be taken out for inventions communicated from abroad is very good, because the great object is to improve the manufactures of the country, and whether it is done by invention here or invention abroad, I think the object is desirable; we are indebted to the Americans for a great many important inventions which come under that denomination. I think that so far as the law prevents a patent from being taken out for an invention communicated by a British subject abroad, it should be altered.

Have you any other observations to make upon the patent laws?—There has been much complaint as to the expense of patents; I am of opinion with the last witness, that if you decrease the expense much (and unless you did, it would be no benefit), it would so increase the number of patents, that they would become a public nuisance; for, notwithstanding the great expense of obtaining patents, there are patents continually obtained for the most trivial, absurd and old things.

Does not the expense of patents operate very unequally upon different inventions?—I am not aware that the cost of a patent upon any article of importance has ever been an object after the first year.

Are there not many inventions the success of which must necessarily be limited to the first or second year, and afterwards the thing from its very nature will be forgotten, such as the kaleidoscope?—That is an instance I had in my mind the moment the subject was alluded to; but that invention, though it was only popular for a very short time, was so popular, that I apprehend the expense incurred in obtaining the patent was no object; and I do not recollect any other instance.

May there not be many articles of fashion which last only for a season?—There are articles such as straw hats, and things of that sort; but still the sale has been very great, if they have been at all encouraged.

Would it not be fair for such ephemeral inventions to allow a person to take out a patent for a shorter period than fourteen years?—I should apprehend more inconvenience than advantage would result from such a course.

Would it not be a better check to patents being granted for frivolous inventions, if the parties who were to judge of the propriety of granting patents were more narrowly to sift them in the first instance?—It would certainly be a check, but I do not perceive any advantage in that check, but a great deal of discontent would frequently arise; parties would complain of being prevented.

Have you any other suggestions to offer to the Committee with regard to the patent laws?—I conceive that all the defects, or at least a great portion of them, might be remedied by a very different mode of obtaining patents. The present mode, which is dependent upon the King's leisure for signing patents, which he is called upon twice to do in every patent, is a very great inconvenience to the subject; because I have known patents to be delayed several months waiting for His Majesty's signature, during which period the invention has been discovered by others, and the patent rendered of no effect.

Would your idea be to dispense with the sign manual?—My notion is, that if the Crown would allow the prerogative to be interfered with, an Act, authorizing the patent to issue from an office, would be an improvement; and I think that if a specification were made, the first course to be adopted, instead of the last, that would be an improvement; I think if the specification took the place of the caveat, and were entered for twelve months, or some definite period, with power to substitute at a certain period a more perfect one, it would be an improvement; that is, that the patent should take date from the lodgment of the specification, and that the party should be at liberty to consult all the world in preparing his specification.

Would you have that temporary specification detail the invention in some degree?—I would have it so perfect, as that the parties could make it subject to revision from the experiments and inquiry of others.

And of course, the thing described in the subsequent specification must be fairly deducible from the thing laid down in the first specification?—Certainly, it must not travel out of that.

Would you have the first specification go into considerable detail?—I would have it as perfect as the parties could make it from their own mind, or their own confidential friends assisting them.

Would it not be an evil to allow a very general specification to be made?—Certainly; I would make that first specification, if possible, a perfect one, subject to

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all the rules by which specifications are now drawn: I think it would also be an improvement if all specifications were inrolled in one office; and I think it would be better if they were not literally inrolled, but copied into a book; I think it would be very advantageous if all the specifications were collected from the several offices, and properly indexed and properly made out, so that they should be of easy access.

Are they of easy access at present?—I think not.

Are you aware of any classed list that is made out?—No perfect one. The best book of reference upon such subjects, as far as it goes, is Dr. Young's Lectures; but in the office there is no list, but a list of the names.

So that a person, wishing to learn at the public office what patents had been taken out, would have to make a very long search?—A very long search at the Inrolment Offices; they could give him no information but such as he particularly inquired after.

Mr. John Macarthy, called in; and Examined.

Mr.
John Macarthy.

HAVE you any suggestion to offer with regard to the laws relating to patents?—With reference to the price of patents, I think it is too high. To a man like myself, an officer on half-pay, and having a family, it is a very heavy expense; and I beg to say, with reference to the specification, that in all the patents I have taken out, of which I have had as many as four, I have always taken care to have six months, but in more instances than one, I have known six months not sufficient time. I have been obliged to specify before the matter has been ripe; but at the same time I believe there are many inventions that would allow a patentee to inrol his specification almost the next day. I want at this moment to take out a patent with reference to a shoe for an elephant in India, but I must traverse by proxy to India before I can specify. I have heard that it has been proposed that there should be a Board to sit upon inventions. I believe it is the practice in Russia, but it is productive of a great deal of mischief to inventors: inventions are often brought before them, with respect to which they are not competent judges whether they are good or not, and they are often in consequence thrown out; an invention may appear a very silly thing, but at the same time it may turn out a very profitable thing, and there may be a very valuable invention that may perhaps come to no good.

Supposing there were a Board appointed, not composed of lawyers, but of scientific men, and that their attention was to be directed not so much to the usefulness of the invention as to the sufficiency of the description, should you have any objection to a Board of that sort?—No.

Lunæ, 1^o die Junii, 1829.

Benjamin Rotch, Esquire, called in; and Examined.

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HAVE the goodness to give the Committee any information you can upon the subject of the present inconveniences of the Patent Laws, and any remedies you think might be applied to them?—I am of opinion, from the experience that I have had in that particular branch, and to which I should say I have directed particular attention, that I certainly think the difficulty and uncertainty attending patents and their specifications, is a cause why the government do not receive at least three or fourfold the amount they would, of revenue from that particular department; but I am not at all of opinion that the uncertainty of patents, and of their being maintained, depends particularly upon the faulty mode in which the description of the invention is often set forth in the specification; I know there is a very strong opinion abroad, by the public at large, that it would be desirable, if a commission was appointed, to examine into every specification, and that that commission having decided that a specification is good, the patentee should be absolved from all responsibility on that head. To that I think there are a great many serious objections, and particularly for this reason,—as a perfect description of the specification is the only thing the public get in return for the monopoly for fourteen years, which is certainly a very great boon for any individual, you take away certainly from the interest that the patentee has in giving that fair description which will enable the public, when the patentee is dead, we will say, or the patent expired, to benefit by the invention to the full extent that the patentee himself did; you take away his incentive

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incentive to do that, if you take away his responsibility that it shall be correct, and throw that responsibility on the commissioners; for certainly my experience tells me that, in three cases out of four, it is the main object of the patentee to deceive the public if he can, and nothing but the dread and fear of losing his patent altogether keeps him constantly from imposing on the public by a false description. In some cases, even that fear will not operate; a case that I may mention is familiar to almost every body, and will illustrate what I have said as well as any thing I can say: in the case of those elegant visiting cards which have been lately shown about with an enamel on them, that is produced solely by a particular white colour which is brought from Germany; the inventor, a German, came to me on the subject of his specification, and told me it was done with the purest chemical white; I said, "it appears to me it must be the German white" (Kremnitz white); he said, "it is the purest chemical white;" shielding himself under the knowledge that the Kremnitz white was purer than any other; he would not allow me to put in his specification the Kremnitz white, but made me put it "the purest chemical white." I said, "you take the responsibility on yourself, and recollect if your patent is ever upset on this point you absolve me upon it," and I even made him write a note to that effect; and years afterwards, during the whole of which period the English manufacturers had been trying to make it and had failed, somebody says, "it is Kremnitz white;" I believe it was Ackermann, who is a German, and they repealed the patent. I supported it all I could, and contended because Kremnitz white is the purest chemical white, it was accurately described, not *eo nomine*, but by a faithful description, in saying it is the purest chemical white; but the Lord Chancellor properly said at once, "this is not a description on which the public can act; at any rate the patentee knew a better one:" that will only show the Committee the feeling there is, if possible, to conceal something from the public. You might succeed with commissions nine times in ten. Commissioners almost uniformly get careless in their office by time: they have not the same motive to put so much zeal into their examination of specifications as the patentee has himself, if he knows it must be upset at any time however long, if any fault is detected in it; therefore, when one considers monopolies (when that name is given to them) always have a degree of odium in the public eye, and when you consider that the specification is the only return a patentee makes for the monopoly, it does seem extremely desirable that every possible incentive to induce that man to do right should be held out to him. It is also a fact, that as the specifications are now drawn, certainly in the course of my practice, (and I have thought about the subject since my attention has been brought to it by the summons I received from the House,) I never recollect but one case in which a patent was upset for want of a proper description merely of the invention in the specification, that is, with regard to the mechanical means of carrying it into effect; that is to say, a description by which a person could not do the thing if he was set to work to do it. Many patents are upset on the specification, but then it is on points arising out of the law as it now stands, which is in itself uncertain, from circumstances that I will endeavour to explain, and which certainly, to my mind, wants most material alteration. In the first place, the statute of James, which is called the Statute of Monopolies, passed at the time when those injurious monopolies were granted, which are now restrained by the statute restraining all monopolies except those for patent inventions for fourteen years; and the words of the statute, which are extremely well calculated for those times, do not happen now at all to hit the necessities of the present period. The consequence is, that the Judges are constantly straining the meaning of this Act to make it meet the necessity of the times. Thus it exactly depends on the extent of laxity that a Judge will venture to give as to what the law at this particular day in any particular court happens to be on patents. The word in the statute is "manufactures"—that monopolies shall be granted for fourteen years for the sole working or making of any manner of new manufacture within this realm; then comes the question, what are "manufactures;" now if it is discovered that in bleaching cotton, instead of dipping it, we will say, first in an acid, and then in a water to get rid of the acid; if it is found better to mix the acid and water together, it may be an improvement of thirty per cent value to the manufacturer, and that advantage in the process is no doubt most important in the present time, when every thing depends on the excellence, the rapidity, or the cheapness with which you do a thing. In fact, three patents out of four are taken out for new processes, by which well known ends are obtained; that cannot be considered as a new manu-

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facture; a new process by which you obtain an old manufacture is not a new one; it is a mere mode of putting together known elements to effect a known end. But some Judges, my Lord Tenterden for one, are so open to the necessity of granting patents for these things, because they are so vastly important, that they will say, "that is the meaning of the word, 'manufacture.'" Another who is a statute lawyer, would say, "nonsense; *manufacture* means no such thing, this is only a process." A man takes out his patent with this conflicting evidence as to the Judges, for "a new manufacture of bleached linen." Then that will be upset in the specification, because one Judge will say, "it is not a new manufacture, it is a new process." If he takes out his patent "for a new process of bleaching linen," he will again upset it, because he says, "You cannot have a patent for a process;" he will quote the authority of Lord Mansfield, who says,—the way in which you can determine what is a patentable article and what is not, is simply by asking yourself this question; Is it a vendible article or not? who shall say, mixing acid with water, instead of using them separately, is a vendible article. The Judge, who is adverse to Lord Mansfield's decision, says, you cannot have a patent for a process. Then Lord Tenterden, in a celebrated judgment which I have here—The King and Wheeler, attempts to determine what a new manufacture is; the words of his Lordship show how completely he is puzzled to make it mean what patents ought to be granted for at the present day, to meet the times. He says, "the word manufacture has been generally understood to denote;" he only says, "has been *generally understood to denote* either a thing made, which is useful for its own sake, or vendible as such; as a medicine, a stove, a telescope, and many others; or to mean an engine or instrument, or some part of an engine or instrument to be employed either in making some previously known article, or in some other useful purpose, as a stocking frame, or a steam engine for raising water from mines; *or it may, perhaps, extend also*;" that is what I complain of, as the cruel judgment which makes the law uncertain; "or it may, *perhaps*, extend also to a new process to be carried on by known implements or elements acting upon known substances, and ultimately producing some other known substance; but producing it on a cheaper or more expeditious manner, or of a better or more useful kind; but no merely philosophical or abstract principle can answer to the word "manufacture." That little word *perhaps*, sets us all at sea, and nobody can say positively what title to a patent the courts will support or will not.

What remedy do you propose for that?—This difficulty embraces undoubtedly almost all the points on which patents are upset on the specification. I will come in a moment to the remedy. The second point is that on which patents are upset most frequently; for on these two points almost all patents are upset. It is the novelty of the invention, which has nothing to do with the specification at all; and it is a false idea to suppose it is the want of a just description, by which a mechanic can follow the process or make the engine that is the subject of the invention, which causes the patents to be upset on the specification. Now the remedy that I would suggest for this indecision in the Judges, is to make an extension of the statute of monopolies. Another distortion, however, the Judges have made of this statute, because it was not wide enough to meet the necessity of the case: the statute says, there shall be no patent granted "except to the true and *first* inventor thereof," and yet we find the Judges sanctioning the grant of patents for importation of inventions from abroad; and the Judges say (to my ear excessively absurd) that means an inventor; a man who imports from abroad is an inventor; and in order to make it come within the statute, without which they could not grant it, they distort the meaning of 'original inventor,' by saying a man who has a friend, who writes a letter from abroad, "such a thing is in existence," takes out a patent for it as for an importation, expressly so stated in his affidavit, and that person is held by the Judges to be the inventor. That is merely to show how the Judges are obliged, from the change in the times, to strain the meaning of this unfortunate Act. The remedy therefore I would suggest, to put all this straight, is to adopt the common sense decisions of the Judges, and to form a statute which shall embrace those objects which, although without the pale of this Act, are every day the object of patent grants, and sanctioned and supported as such in courts of law by the Judges. Now I would therefore suggest, the new statute should not limit the granting of patents to fourteen years merely to any manner of new manufacture within this realm, but it should embrace the following heads, which I have taken the liberty of writing down, and which, as it appears to me, are all heads which

which are now sanctioned by law, although not by this statute, and confirmed by the decision of some of the Judges. The first would be "A new manufacture or an article of sale;" and it is difficult to find a proper term to use; some people say an engine is not a manufacture; I adopt my Lord Mansfield's opinion then, that it means a vendible article: secondly, "A new process of making either a new or a known manufacture, or article of sale;" and, thirdly, "A new application of a known manufacture, engine or article of sale, such not being patented at the time." This will need a little explanation; it has been held by the Judges, that when an individual has an invention which is patented, no improvement on that ought to be allowed as the subject of a patent, because the merit is in the original invention; as, for instance, the great steam engine; there were no improvements allowed on steam engines until after the patent had run out, except such as Watt and Bolton invented; after that had expired each man could have a patent for any particular improvement of his own. Therefore I have said a new application as one subject for granting patents; a new application of a known manufacture or article of sale, such not being patented at the time. Then the fourth head I should suggest should be, an improvement on any known manufacture or article of sale not being patented at the time, or being patented, not without the consent of the original patentee. Perhaps I might illustrate the first, of "A new application of a known manufacture," by referring to a pair of bellows; suppose a man has obtained a patent for a pair of bellows, and he only knew it as an engine for blowing the fire—increasing the heat of a furnace; it has been laughably enough said by my Lord Eldon, "would you then," (he was averse to granting patents for new applications to known inventions,) he said, would you then grant another man a patent, because instead of blowing a fire with those bellows, he blows the dust off his pictures with it; that is a new application;" my answer is, no; but by a new application of a known invention, I mean such an application as requires some modification to adjust it to your purpose. For instance, a bellows being only known as an engine to blow a fire, I would say that the inventor who first applies it to the purposes of an organ, and arranges it and modifies it in such a way as to suit the purposes of that particular instrument, is entitled to a patent for his application of a bellows to that purpose; and therefore a new application of a known manufacture, or article of sale, I should limit to such an application as requires modification, and an invention of something for the purpose of so applying it. Then under the fifth head, I would class "Inventions imported from abroad not before used in this kingdom." I contend that they are not at all provided for in the statute of monopolies, and that it is not only a strained meaning of the words to decide otherwise, but an absolute perversion of the statute. I think it highly important that inventions imported from abroad should be patented, because I have had much experience to show how many we never should have had if it had not been for that statute which protected them for fourteen years. That is the end of the list.

You have stated you would not allow a person to take out a patent for an improvement pending a patent for that article already obtained by another person, is that the distinction you draw?—It is; let me explain, that there is one modification attached to that also, which I omitted to mention, as there is to "A new application;" the new application, unless there is some invention connected with it to make it applicable to this new purpose; so I would also put a qualification to the fourth head, which is the improvement, and which is in fact now held by the Judges, namely, that you shall not have a patent for an improvement on a patented article, unless that improvement is something that may be sold totally separated from the article already patented, so that you shall not involve any part of the original invention to carry off, as it were, your improvement.

By that means, supposing you had a patent, and a great improvement was discovered by an individual; if he had your consent, if that was made into a law, would he be barred from going forwards, with the consent of the original inventor?—There could be no difficulty in that, and for this reason; he could still come to me and make an agreement with me, without that being part of the law; he could come and say, "You may have a great improvement in your patent; your patent protects me already in that improvement, if you will agree with me; if I tell you the improvement and you adopt it, we may share in the profit;" but the original patent will always protect that improvement, and there is no necessity for a patent for the improvement. I think it desirable that the public, or that an individual should be restrained from, even with the consent of the party, taking out a patent for an improvement; because from my experience in these matters, I know it

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would lead to endless quarrels and disputes, as to the consent being given or not being given; and moreover, because I have always felt, although that is of course for the Committee and not for me, that it is useless to legislate on a point which protects itself; and that as the original patent protects the improvement, so the individual who takes out his patent or who has an invention, goes to the patentee to get his consent to make use of it, which would be the advantage, as if he did it under a patent; with this exception, that he can only enter into that agreement for the remainder of the term of his patent: but look at the danger of allowing patents for improvements, even with the consent of the party, on articles that are already patented; it would continue a patent *ad infinitum*; improvement on improvement, just as their fourteen years are expired; because it is what patentees come to me constantly to know; if they cannot for some little improvement obtain a patent on their own patent, which would be an extension of the term to twenty-eight years instead of fourteen, and thereby shut the public out of the benefit they are to have at the end of the fourteen years.

How would it carry the patent on for double the time; supposing the patent was a slight one, the public might use the patent article without the improvement; would it not only be to secure the improvement?—The only way I should explain that would be this; if the improvement is a thing *sui generis*, of itself distinct, any particular safety valve to a steam engine; if the use of that is of particular importance to the steam engine, the valve as a valve may be patented. I will suppose a steam engine to be now known for the first time, and to be a patent article; if you take out a patent for an improved steam engine, and introduce that valve as the improvement, you carry on the patent for the engine and for the valve; by uniting the valve with it you carry on the patent for the engine for another fourteen years; but if the valve is so distinct from the engine that you take out your patent, not for the improved steam engine but for the improved valve, or a valve applicable to a steam engine, you may have that at this day; because whether you apply it to the steam engine, or not, is a matter between you and the patentee of the steam engine: that comes within my qualification of this head, which is an improvement which is of itself distinct, and may be used without the original invention, and is such a thing as you may now have a patent for.

But supposing a person taking out a patent for an improvement, and he includes in that patent the original article, in such a way as to preclude the public from making use of it, would not that be a forfeiture of the patent?—Yes, according to the present law, if he include it as a part of his patent, because a patent that is bad in part is bad in the whole: a man cannot take out a patent for an improvement on his own patented invention, any more than he can on any other person's; and if he should include the original invention in a new patent, with the improvement, provided the original invention be patented, he forfeits his patent; but if he waits until the end of the term for which the original article is patented, he then can take out his patent for the improved steam engine.

Have you any objection to the law remaining in that state with respect to improvements?—I cannot quite comprehend.

Do you see any objection to that state of the law?—Not the least in the world; but I want it should be provided for by statute, and it should not be in the breast of one Judge to say that is not law, and of another to say it is law; it is only the present state of the law according to the decisions of the Judges, but not according to the statute of monopolies. One Judge will fly back on the statute and say, improvements are not provided for in the statute—"I hold this is bad;" another will stretch a little further and say, "this ought to be the subject of a patent, and I will hold it to be so." I myself wish it to be made the statute law. These heads have appeared to me to be such as would embrace all the decisions on what are now held to be the subjects of patents, whereas only one of these is embraced, strictly speaking, in the present statute of monopolies; but there is another point on which all the Judges are at variance, not only with each other, but with themselves, sometimes deciding one way, and sometimes deciding another; and the only person who seems to have been uniform in his decision on the subject is the present Lord Chancellor, and that is, whether or not *a new principle*, reduced to practice, may be the subject of a patent. This is the most important head, and therefore it is extremely important that the law on that subject should be defined. I consider that there is no need to introduce a head classing that as one subject of a patent, because it is not sufficiently defined, or a new principle reduced to practice; but I consider it would be of prodigious importance to the public, if my Lord Lyndhurst's decision

were

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were made law; namely, that although you can have no patent for a merely philosophical or abstract principle, that you may have a patent for a new principle, provided that new principle be reduced to practice; and I will take the liberty of giving an illustration, as perhaps the most familiar mode of bringing it home; that is this, a person in Scotland lately has discovered, where the great object is to save time in distilling their spirits, for time and heat is every thing to them, he has discovered that by throwing his wash into his boilers in the form of a shower, as we will say, out of the holes of a watering-pot, which brings it into a shape that exposes a vast surface of the wash to the heat, which otherwise could not be if it laid in the mass as one undisturbed quantity; he distills four times as quickly perhaps, and saves therefore a large proportion of coal and much time. It never has been done before; I assume, for the purpose of the argument, that it has not. Now there are fifty ways of affecting this; you may force a jet against a triangular piece of metal with such force as to distribute the whole into a complete mist in the still; you may do it by driving it through horse-hair cloths, which will let it come through in drops, every drop has its whole circumference exposed to the action of the heat; the grand invention was the first thought of exposing wash in that minutely subdivided state to the action of the heat. He has described and perfected one way of doing it; but it is suggested to him directly there are five hundred other ways; must I describe all these ways in my specification? I say no; the patent that is for a principle, is in fact the only patent that is worth having; because, for example, a hat is known; where you take out a patent for an improvement in the dye of the hat, another in the stiffening of it, it is only as far as each process goes he can have a patent; if another man finds out a better way to do the same thing, he can have a patent also; but if hats had never been dyed black before, and that was found to be useful and possessed of many advantages, the man should have his patent generally for black hats; so with regard to this, the invention is subdividing the wash as it is exposed to the heat, the causing it to be exposed to the heat in that state: if another man could come and take out his patent for causing that mist to arise in the pan in another way, where is the use of this first man's patent? although the second man might not have ingenuity to think of the thing, yet, being once told of the new principle, he could invent a better mode of carrying it into effect. That the law has been acted on by some Judges, which I would wish to establish by statute, is quite clear from the case of Bolton and Watt; the moment the term of their patent grant expired, which was extended to twenty-one years, there were numberless improvements immediately, and are to the present day; none of the same value to the patentees as the original invention; because there were competitors.

You began by stating that this shower would be a principle, a new principle?—Yes, supposing it to be done for the first time.

But if that be so, if it had been done in a steam engine before to raise steam—then would you call that a principle as regards distilling; both is raising a vapour?—That is getting a legal opinion from me as a lawyer, on a subject which does not touch this question; because you will understand I am here only contending it would be extremely desirable to extend the law to any new principle reduced to practice; I do not pretend to say what are new principles, that must ever be determined by a jury: I have put the shower as an illustration of a principle reduced to practice; the question you have asked raises a special case as to the novelty of a particular question.

Is it not the law now?—Only in the breast of the Lord Chancellor. Lord Tenterden says, no merely philosophical or abstract principle can answer to the word "manufacture;" that is taken hold of as laying down broadly you could not have a patent for a principle. I will tell the Committee where it was acted on the other day, and a decision directly against the patent; and where it was reversed again on an appeal, and held to be right; which shows no man can say what the law is on the subject: in the case of shearing cloth, it was discovered that a much finer nap was produced by shearing the cloth from list to list, that is from one side to the other, than by shearing it lengthways—a machine had been prepared for shearing it lengthways, which was a roller with knives on it, running round very rapidly against a rail which had one blade on it, and passed along the cloth lengthways and thus sheared it; that was the first time that a cutting roller had ever been used. A man took out his patent after this had expired, for the application of the roller for shearing cloth from list to list, which had never been done before, and showed how he did it by a machine which adopted this roller, which was previously known, to this purpose

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pose by a new arrangement; therefore there was a principle of cutting from list to list, which was the important point reduced to practice by this new mode of arranging this roller; he took out his patent for shearing cloth from list to list; the lawyers were all up in arms, and said this is a patent for a principle, a mere idea, shearing cloth from list to list. On the other hand it was contended, the man has reduced his idea to practice, and he shows you how it may be done, and any man reading the specification can do it: shearing from list to list by means of this roller is the grand object, and then he takes out his patent for doing it by a rotary cutter, which had never been done before. Some of the Judges would have upset the patent; Lord Tenterden maintained it, and said distinctly that the principle being reduced to practice, and the principle of shearing from list to list with a rotary cutter being new, the patent was good. How can a lawyer after that be certain how to advise his client? he cannot say, "my advice is if you try that before one Judge such will be the result, or before another Judge such will be the result." I want it to be made law by statute, so as to prevent the Judges varying in opinion on that point; and it appears to be common sense, that a new principle reduced to practice should be the subject of a patent, provided it be new; if it be not new, that is the subject for a jury to decide; whether or not having been used in a steam engine, for instance, does away with the novelty of the principle, should be for a jury to decide.

Can you define a principle?—Any new principle reduced to practice.

It might be as to distilling a new principle, as to raising vapour for another purpose it might not; if you talk of principle, the query is whether you will not find there cannot be a principle discovered?—If there be no such thing as a new principle in what the patentee claims, then the patentee cannot have his patent for it; that is quite clear, and his patent would be upset.

Looking at it practically, would not the same thing be gained by saying there should be no patent for a principle? You say, there should be no patent for a principle, unless reduced to practice; is not the reducing any thing to practice which is new, patentable, without talking of principle at all?—It is necessary I should give an example before I can satisfy that question.

How do you define a principle?—Johnson's Dictionary definition of it. Whether a thing is new or not must be the subject, and I hope ever will be the subject for a jury to determine. Do the Committee wish me to state what I conceive may be a new principle?

How is cutting from list to list a new principle. Is it not a new practice?—It is new to do it with a rotary cutter. I make use of the word principle, as it is commonly understood by the world. I will suppose raising the upper masts of ships by means of a lever has never been done before: if a man takes out a patent for raising a mast by means of a lever, no modification of that should be allowed to cut him out of his patent; the principle is raising a mast by means of a lever. If a man takes out a patent for exposing liquid in the form of mist or vapour to the action of heat, he may apply it; and he says, I show you how I do it; he applies it to a still. If it could be shown that is done before in a steam engine, the principle is not new; the principle is the same in both these inventions, and he should have taken out his patent under the third head I have suggested, namely, for the application of the known principle to a still. He should have confined it, and this would be a subject of controversy among counsel at the trial, but which I hope no commission ever will be appointed to decide on, but will ever be left to a jury to determine. One man says, "it is only a new application;" a man is at liberty to take out his patent for a new principle, or a new application; if he elects to take it out for a new principle, and it is old, his patent will be upset as a matter of course; but if he takes it for a new application of a known principle, the use of the steam engine will not upset his patent. That does not affect the general question as to what I propose to make law; the case proposed to me is merely a particular one, in which the patentee may have done wrong, and if so, will forfeit his patent in consequence.

What the Committee would ask is this, as to that which you have defined to be a new principle,—whether you would consider a man taking out a patent for that principle, would give him the exclusive use of it, both as for distilling and as for the steam engine; taking it in that sense,—whether you consider it a new principle in each, or only a general one that would ride over each?—That again, as I said before, is a legal question; it must depend entirely on the way a man takes out his patent: and supposing the principle to be new, and a man takes out his patent for the principle of exposing water in the form of a shower to the application of heat,

as a good mode of raising vapour; if he takes it out for that, then I say he shuts the public out from using that principle for any thing. Is the law different at the present day? I am not aware I am introducing any new law, I am only settling what is law. Look at the steam engine, that was a patent distinctly for a principle, and whatever that steam engine was applicable to, and whatever modification it required to make it applicable to different purposes, no man was allowed to take out a patent for a steam engine, or to apply the power of steam to mechanical purposes during the period of Bolton and Watts's patent.

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What do you call the principle of that patent of the steam engine? Now describe, in words, what it is?—Unless I have the patent before me I cannot describe it.

What is the principle?—I do not sufficiently recollect the patent, but I can describe the lever-fid principle, if that will explain my meaning to the Committee.

You said, the patent was distinctly taken out for a principle?—Yes.

Interpret to the Committee what you meant by the word 'principle'; in that case, what was it that entitled that patent to be called one of principle?—I will take another patent that I am more familiar with, for my illustration. A person takes out a patent for a lever-fid that supports the topmast of a vessel; a man takes out a patent for doing that by means of a lever; I should say, the principle is the doing it by means of a lever, however arranged or contrived.

Would that embrace a screw; a screw is a lever?—Certainly not; it has been held over and over again, that we are to take terms as they are understood mechanically and technically, and not philosophically. I never knew any difficulty to arise until to-day, as to defining what a principle is; but there is a difference of opinion as to whether a principle reduced to practice should be the subject of a patent. Let me name another instance, a gas apparatus; for the first time gas was allowed to enter into a wheel and turn it round; it was the first time that ever a revolving gasometer was made use of. The one that was originally made, was found not to answer at all, it was thrown by, and another man taking the idea of a revolving meter, invents one that does act; it goes on for ten years; everybody adopts the latter, nobody the other. Lord Tenterden held, although they were not at all alike in practice, yet in principle it was the same thing; it was the gas forcing its way through the wheel that turned it round, although they had entirely altered the shape, and made it perform in a totally different manner, yet Lord Tenterden held the principle in both was the same, and the principle was pirated.

What would the law be upon that; the first man would not be able to adopt the second man's plan?—Most decidedly he would.

Was that held as law?—That was held as law; it was proved the first man immediately laid by his own invention, and has never made any but of the second man's plan.

He was held justified, because he was the first inventor of that principle?—Yes, of a rotary meter.

Your objection to the present law is, some Judges would have held that not so?—Three I know would hold the contrary. I was for the defendant, and I said, if a certain Judge tries it, we shall succeed as a matter of course; if another tries it, we shall lose it; that is a terribly uncertain state to have the law in. I believe I have exhausted the subject of the fifth recommendation as to the statute; my object is to show the necessity of having the Law of Patents altered to meet the circumstances of the present era of inventions, which the old law does not; there being at least nine patents out of ten which will not, strictly speaking, come under the present statute of monopolies. The next subject on which patents are upset is for want of novelty; that is also a very important subject, and one which, if it could only be secured to patentees, would be of the greatest possible importance to them; it is not possible for any man to know what has been done before twenty or thirty years or forty years ago. The statute, for I cling greatly to the statute, inasmuch as I know statesmen are very unwilling to make new laws where the old ones they think suffice (I think the old law does suffice), that it was wise and good, but that the Judges have completely perverted it in the present day; with regard to that, instead of altering the law, I would only wish them brought back to the very letter of the law: the words of the statute are with regard to novelty, because it is necessary an invention should be new; the statute says, "the first inventor of such manufactures, which others at the time of making such letters patent shall not use;" in the present tense. Now it very often happens (I am speaking now from an experience of fifteen years) that this does constantly happen, namely, that a person

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(I will say ten years ago) invents a machine, which, for want of just exactly the right thing, which is of the most importance, does not act; he tries it; it is a complete failure; the thing is thrown by; some eight or ten years afterwards every body (I will say it is an invention for spinning), every body is trying who can save an hour in the spinning of cotton; it is likely a second person may invent the same thing, or may catch at the same principle; he adopts a different mode of carrying it into effect, and being a little more clever than the other, he hits on the point the other wanted, and makes his a most valuable invention; he takes out his patent for it; away comes the other man, who ten years ago invented something that involved some few of the parts this new invention does; he says. "I made such and such wheels, and put them together for the same purpose ten years ago; I did this much of it," and that patent is upset: and my experience teaches me another thing, which is a still greater hardship, arising out of the same circumstances, which is, that if a clothier in the west of England has a patent, one single man is called from the north of England, who comes down into court, and having read the man's specification, stands up like a parrot, and will be found to swear, fourteen or twenty years ago I did so and so, and so and so, exactly verbatim repeating the specification; the patent is upset; nobody can provide against such evidence as that; and I do not hesitate to say, there is more perjury in that one particular (and I am sure I shall be held out by a member of the Committee, who I see on my right) than could be believed by a Committee who have not experienced what we have. That arises from two causes; first, because they do not adhere to the statute, which I think a very wise one; and secondly, the perjury that interested people are enabled to procure by suborning witnesses, which is of common occurrence. It is always the interest of the whole trade against the patentee combined; they combine their money in the first place, and then fight away and procure witnesses at any price.

You mention this arises from not adhering closely to the statute?—The statute confines the novelty to such manufactures as others at the time of making such letters patent shall not use. Now I apprehend, if it was clearly understood, that if a thing, from any circumstance whatever, has gone out of use, the man, provided he be also the inventor, though not the first inventor, who introduces it in such a form again as shall make it an object to be very much desired indeed, is entitled to his patent; if it is not an object of that value, where is the harm of granting him the patent if he makes nothing of it? if it is not in use, there is no vested interest to be injured by granting it; and if he has produced it in a more efficient form than the other, he is entitled to a patent: it is not like the case of a man who takes out a patent for an article which is in use, and another invents a little improvement on it; that would be a hard case. But I am supposing the original invention has utterly failed, is laid by and forgotten, and is not of use, then the man who invents it a second time, and brings it forward in a form that makes it useable, I should conceive is entitled to a patent: it is also impossible, as a point of evidence, for any man to ever meet that one point of novelty: supposing it is a cloth patent: counsel say "yes, I think your specification is good; I think your title is good; you have clearly proved the infringement; but some fellow or other will come and say he has used it before, and you are done—are you sure they will not do that?" the reply is "they cannot; I must have known it; all the trade must have known it; all the clothiers and tailors in London come forward and say we have not known of such a thing; it is invaluable, it makes the cloth worth two shillings a yard more; it must have been known if it had been adopted." A man out of Yorkshire comes and simply swears, "I made a piece of cloth in that way;" "who did you sell it to? cannot tell." "Did you make more? cannot recollect, but I did that;" and he sticks to it, and you cannot get over it. The patent I allude to was upset, and a most valuable one it was.

Does the difficulty of rebutting that arise from the length of time?—Yes, they take care to go far enough back; ten years ago or twelve years ago; how can people get evidence in a country, about a spot, and connected with people that he never heard of up to the time of coming into court? the Judge directs them, the Judge says, (we have the case in point of the lustre for our coats, which was upset; an immense fortune was to be made by it; the party was receiving many thousands a year regularly for the patent; it was upset exactly in that way. I asked the question, could a jury believe such a thing) the Judge said, "you must believe it, they have no evidence on the other side; this man swears distinctly he did it; no man can know as well as himself; if he swears he did it, it will be on his own head if

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if he tells a lie." The Judge tells the jury, "you must upset the patent," and they do it; it constantly happens. I should conceive that the meaning of the Act clearly was, that if at the time it was not in use, and thereby throwing only the *onus* on the individual, the patentee, to discover that at the time the thing is not in use; that the public are not injured because they are not making use of that invention, and therefore granting a monopoly enables them to make use of it, because a man can always allow the public to use his patent; he may always grant licenses, the public may have it again, and nobody is injured if it is not in use at the time. I should consider, adhering to the statute strictly in that particular would be the best possible criterion they could have. Even if they thought it necessary to go a little further; limit it within two years; if it shall not have been in use within, say five years, there is some chance of a man getting evidence within five years; but twenty-five or thirty, as I have known, you cannot possibly trace counter evidence to upset it: if a man says I sold it to such a house, the house is gone, partners dead, and broken up. I should say the best thing would be to revert to the present statute, and say "which others at the time of making such letters patent shall not use."

Does it not use the words 'first inventor'?—True, it does, and we must endeavour to explain and reconcile any thing like inconsistency. I would have it suffice that he should be the inventor, though not the first inventor; and as to novelty, that the words of the statute should be adhered to, namely, that it should be sufficient for him to prove, in order to establish its novelty, that "others at the time of making such letters patent did not use it."

Are the Committee to understand you would grant a patent for the revival of an old invention?—If it be really to a second inventor of the thing, provided it has gone out of use entirely.

How would you prove that he is an inventor?—In the same manner as heretofore; a man makes affidavit of that before he can get his patent; we know unfortunately, as practitioners, a vast number of affidavits are sworn as to the first inventor and the true inventor, which are utterly false; we cannot have greater security than we have now.

Would that affidavit be sufficient in a court of law?—No, a patent is always liable to be upset on this ground; and you would have the same security on that score that you have now.

You mean, at any rate, that he must be an inventor?—I distinctly wish he should be inventor.

Would it not leave it open to a great difficulty of proof where the question is whether the matter is the produce of his own breast, and there is proof that it has been invented before, although not used?—There is great difficulty in that certainly; my answer to that is this, however; the same difficulty exists now, and the same provision which in all like cases is afforded by the law, would exist then; that as far as regards the proof of invention, a mere *prima facie* case is enough; if you get a friend to come forward and say—"You are acquainted with cloths?—Yes. You are a draper, did you ever see these lustre cloths before?—Never. Is it likely you would if there had been any?—I think I must." That would be held to be proof enough in the first instance.

Does not that illustrate the difficulty? did you ever see it before?—No, I never did; if he said he had seen it before, that would destroy the case; so it would now.

At this moment, if you attempted to upset a patent, you must prove it has been used before?—The hardship at present is, all the world and trade are against the patentee; they bring one individual to swear, he having the means before him in the man's specification, I did so-and-so; he upsets the patent. We see constantly this evidence is suborned for this particular purpose. The patentee has paid a large sum to government for his patent; he has induced perhaps somebody else to pay a still larger, and he is always liable to this difficulty, of some individual coming and saying that he did it before, whether true or false; it is too easy a proof; that is a very crying evil to patentees; if an individual who came to make that false oath, felt that it was necessary to swear to facts within five years, or within any time that it could be probable other persons could be got at to contradict him, he would not feel safe, and it would be a great check upon the evil.

Would it not be necessary that it should be publicly used?—That is the case at present. In all other countries, except England, if an invention is not put in practice within two years, he loses it.

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Would it not be expedient to allow five years, in consideration of cases in which the first inventor may fail in one or two attempts; and may, after the lapse of three or four years, be able to carry his invention into effect?—Upon the whole I think it would be better that a period of five years should be allowed.

Is it not the case in France, if you do not carry your invention into effect in two years, that any other person may take out the same patent?—Yes, that is so; but it could not occur in this country; in France the specifications are sealed, and therefore the enrolment of the specification does not publish the invention; but in this country the moment it is enrolled it is published.

Is it the practice that all the specifications should be sealed?—Yes.

Or only on application?—They are all sealed as a matter of course there.

And are they not open to the public?—No; except on special applications. Those patents that I have now named show the uncertainty of the Judges as to the determination of the meaning of the word ‘manufactures,’ and is the subject on which one half the patents are almost upset; a quarter of them, or more than a quarter of the remaining half are upset on the score of novelty; and those are the only points which I have to communicate to the Committee with respect to the specifications of patents, and the uncertainty of the law of patents, as connected with the specifications; but I still adhere to my original position, that it is of the utmost importance to make the patent law certain; and it would, threefold, increase the revenue on that head to the government; because it is the uncertainty of patents that renders people unwilling to enter into them: that leads me to another point of uncertainty; not with regard to the specification, but having a reference certainly to novelty: it is a point which depends entirely on that over which the patentee has no control, but over which the government has entire control, and by which the patentee suffers most cruelly. When a man makes his affidavit that he is the first inventor, and petitions for his patent, he does it by giving a title, as it is called, to his patent:—he says, “It is an improved paddle-wheel.” He gives his name and address, so-and-so; petitions for a new paddle-wheel; he puts in his affidavit; he puts in a petition; it is published in all the journals, a man is applying for a patent for such an object, and so on; the man’s name is given; I have known a man fifteen months after presenting his petition and affidavit before he could get his patent passed through the offices. Now a man cannot apply for his patent until he has made some sort of experiment; his workmen are acquainted with his experiment, and if during any portion of that period any of his workmen betray him, or any man through intrigue can get hold of what he is about, that individual may apply for a patent too; or if he has a spite against him, he may make it public, and make use of it, and thereby throw the inventor out of his patent. The patentee goes to a great expense, he has no control over the time it takes to pass this patent through the public offices; and it is granted to him with that heavy expense on his back at a time when he can make no use of it. A man cannot take out a patent without stating what it definitively is, because he is obliged to swear he believes it will be useful; he cannot do that without making experiments, and the making of those experiments makes him liable to be betrayed, which sometimes, as I said before, may be done through a whole space of from three to fifteen months; sometimes His Majesty is ill, it requires two signs manual from the King. There are other reasons why these things are delayed at other times, and this delay is, perhaps, one of the most cruel things to a patentee that can be; he cannot provide against it; he cannot hasten the thing, and he must put himself in the power of others for his patent. The remedy I would propose for that is, that when he presents his petition for his patent, he should deposit the whole amount of fees required for a patent, (which is not the case now, because he may pay as they go through the offices, and he may stop at any moment he pleases and not complete it); and in that return for this deposit (however long the offices may be in passing his papers through them, and granting his patent), when the patent is granted it should bear even date with his petition; that it should relate back; that he should have fourteen years from the date of his petition. The passing of a patent is a thing that might be done in three days if there was any dispatch of business, and if it was not waiting for those several signs manual, which must be dependent constantly on circumstances; but it does seem extremely cruel that the patentee, who is called on to pay an immense sum of money, who does all he can, should present his petition to day, and not have his patent for six months, during which time the secret of his patent is frequently discovered. A man had a patent the other day for a railway; he said I cannot try it in my parlour, it must be a public experiment; if I try it
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now it will be six months before I can get my patent; what a condition I am now in; every body will know it, they will be adopting it, and laughing at me. I do not see there can be the slightest objection to date the patent back to the date of the petition, provided government is secured by having the deposit of the whole amount of fees, so that a man cannot retract and not go on with the patent.

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By which you mean, he should be secured from the time of the petition?—Yes.

Would not that enable him to thrust in his specification any invention of others that he might learn in the mean time, between the time of presenting the petition and the time it is sealed; he may have five or six months; inventions may be made by others which he may hear of, and may he not thrust in under the same title those inventions?—That evil now exists in a ten-fold degree to what is imagined or is stated, and arising out of a much greater evil which I am now going to state, and which always exists on the present system: the man has the opportunity of getting other people's inventions; but I will show he has it to an extent which I would wish to curtail; I will state the course the thing takes: a man applies for a patent, he is told at the Patent Office, if you say, "I mean to take this out for England;" you will only have two months to specify; but if you will say, you intend to take it out for Scotland and Ireland, it does not bind you to do so; but you will have six months before you are bound to specify your patent; well, some man has heard that I am going to take out a patent for something, and he has heard the general terms, and he immediately goes and makes an affidavit he has invented the very thing perhaps; takes my general title, which he can see by paying a shilling at the Patent Office; he takes out a patent, and says, "I mean to take it out for Scotland and Ireland;" and he gets six months before he is bound to detail what his invention is. I know nothing of this; he comes a month after me; I am an honest man; I have no intention of taking out a patent for Ireland and Scotland, when I am told, "if you like to say so, you will have six months; I cannot say so; then you can only have two months; be it so." I am bound to specify when only half the second man's time has run out. I am obliged to specify mine at the end of two months; and I have known instances of a rogue immediately afterwards copying my specification verbatim into his own, for which he has six months to specify, and therefore he can do it. It is a trick that is played and is constantly done in a minor degree; but I have known the full extent of what I have now stated done by a party; and that is a very great evil: but why do they want time to specify? because they dare not make a single experiment before the patent is granted; and when a man makes an affidavit, and swears he believes it will be useful; he has no idea whether it will or not, no more than the man in the moon; he says, "I must get my patent, and then I will make my experiment;" when he gets his patent, he says, "I will employ workmen, I have two months, and I will make my experiments;" he has not time perhaps to make sufficient experiments in two months, and he specifies it imperfectly; because he has been afraid to do any thing beforehand, having no means to secure himself. What I should propose would be, no man should be allowed more than two months: I should also state, that this is only a sort of misuser of the original intention; it was intended a man should have two months for each country; two months from the date of his Scotch patent to specify his Scotch; two months from the date of his Irish to specify the Irish, and two to specify the English; they now give six months to specify the whole by an amalgamation, which is a complete misuse of the intention.

The remedy you suggest would be a sort of palliative, by keeping the title secret?—No; but no man should have more than two months, so that every body should have the same time at any rate, thereby allowing a man to be secure the moment he enters his petition; then one man cannot get the advantage of the other. I have known one man upset another because he had the ear, I will not name names, of a person about His Majesty, who could get his paper signed; and I have known one hundred guineas given for signing one paper before another.

Would you oblige him to describe the principle more fully in his title or petition than he does at present?—Most certainly, in return for the security.

Would it not be necessary to make the arrangement of taking the three patents out very different, if you altered the six months at present existing; inasmuch as the time for receiving the different patents from the countries deviates so much, that otherwise your specification would be sometimes nearly due for the English, before your patent was even secured for Scotland or for Ireland?—There is no need to make any proposition for that; I would wish the original intention should be carried

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into effect; that it should be two months for each country; it is your own fault if you do not choose to take it out for each at the same time; you may do it; if not, you will be allowed two months for Scotland, and two months for Ireland, but not by uniting them all in one affidavit, get six months for any one.

Then would not this difficulty arise, you may have specified for England before your patent is sealed for Ireland, and thereby have betrayed the whole of it completely, so that your Scotch patent would be good for nothing?—Not if you have petitioned at the same time; these are all provisions supposing the patent bears date from the petition.

Is there not a convenience now in allowing a discretion in the Attorney General to give time for specifying?—I was just coming to that; but I wish to refer to a question just put with regard to a person giving a more full description than contained in his title, which is a most important point; and in order to show how important a point it is, I am very often obliged as a barrister, when I find I have a rogue to deal with, to say, “we must have a petition before the Attorney General;” to use our cant phrase, “we must cook up a petition before the Attorney General;” why so? because then it is often made one of the conditions. At any rate, counsel who understand it, can get it made one of the conditions, that if a patent has been granted at all like mine, or for the same subject, I who come afterwards, have shorter time to specify, can make him give a fuller description of his invention than is contained in his title which is left sealed up in the Attorney General’s office, and afterwards his specification, his amplified specification, must correspond with that more detailed title. That is of great importance, if that could be carried a little further, and if that advantage was not unfortunately confined to the very worst tribunal that perhaps ever sat to judge of any thing, which is the tribunal before the Attorney General. I am sure I do not say it with the slightest reference to any individual, but merely to the office, which from its nature must vary. I have known the most competent men in England, both as mechanists, lawyers and chemists, Attorney Generals, and the gentlemen who now fill those offices have had great experience in those sciences, but I have known those appointments filled by men the least qualified as mechanists and chemists; and a man must not only be a lawyer, but he ought to be all three, to decide at that tribunal. That is a subject I will come to afterwards, but as at that tribunal one good thing is effected, it forms a precedent for introducing it into the Act; it is done before the Attorney General; why not, as a return for the boon you get in having your patent dated previously, why not give a more full description in the petition? it would prevent an immensity of fraud if it were so.

Would you propose that the Attorney General should have an assessor?—I am doubtful what would be the best thing to do, whether to appoint an assessor or a commissioner. If it were a commissioner not appointed by the Attorney General, the public would be much more likely to be well served, than by an assessor appointed by an Attorney General, who would be removable with each Attorney General. any Attorney General would appoint any assessor. I am excessively averse to commissioners myself in patents; I think the public would be ill served indeed, by having a commissioner to inspect specifications; but I think in the case of the Attorney General, such gross injustice is done so unwittingly—this applies merely to the situation of things, not to individuals,—but I have seen such gross injustice done at the Attorney General’s office for want of that particular knowledge—it is not one Attorney General in twenty has that mechanical knowledge, I will say grovelling knowledge for him which is required; it must be quite mechanical and chemical knowledge—I have seen great injustice; there is about twelve pounds charged at each opposition to the parties. The Committee is not aware, perhaps, when a man takes out a patent, his petition lies at the Attorney General’s office for a week, and every body who has a caveat entered on the same subject, is written to and told, “such a man is going to take out a patent on the subject you have a caveat for; is it your intention to oppose him?” That gives every body an opportunity to do so; and it is commonly the practice, and it is generally my advice, arising out of circumstances, to oppose by all means; ten chances to one a mechanic puts questions which the Attorney General does not see the bearing of, and you have a great chance to find out what it is before you leave him; that occurs from the want of that knowledge which it is not necessary an Attorney General should have for any other purpose, and which very few have. There is no appeal from that tribunal, because if I apply for a patent, and another opposes me, and he says he has used something like it some years ago, and he shows it to the

the Attorney General behind my back—for he receives each party privately,—he then comes out of the room; I go in, and state what my patent is; the Attorney General says, “I cannot give you a patent for this, because it is in use already.” I say, “tell me what it is—Oh, no!” you are entirely at the mercy of the Attorney General. If a man has dressed up any thing that looks like it, or which the Attorney General in the want of mechanical knowledge, thinks like it, he determines at once you cannot have your patent; he will not report to the King it is a proper subject to have the patent granted for, and you have no appeal whatever from his decision; that of itself shows the necessity of having a competent person to judge of the similitude of the inventions. I should say a commissioner would be better than an assessor.

But if you propose it to be secured when you first put in your petition, could you limit at all the time of a dispute before that or any other tribunal?—Of course, not. I should say, it would be far better not to have any such limit, provided none of those difficulties which I have mentioned were thrown in the way of a man.

Mr. Walter Henry Wyatt, again called in; and Examined.

WHAT do you produce?—I produce a Register of Patents from 1675 until the present time. I have an Extract of the Law of France relative to Patents, which I wish to hand in. I wish to hand in an Account of the Number of Patents obtained, and of those now in force. I produce also a Compendium of the Law of Patents, and the Repertory or Patent Inventions, N° 48.

Benjamin Rotch,
Esq.

1 June,
1829.

Mr.
W. H. Wyatt.

Mercurii, 3^o die Junii, 1829.

Arthur Howe Holdsworth, Esquire, a Member of the Committee;
Examined.

ARE you prepared to furnish the Committee with any suggestions upon the subject of the Patent Laws?—I will furnish them with such information as has come to my knowledge from facts that have occurred to myself, not assuming any thing of a legal opinion; leaving to the Committee to form their own judgment, as I shall do myself, upon the things that have occurred. To make this subject as clear as I can, I would first state that there are patents of various sorts; I would divide them first into two, one for a process for articles of which the patentee is himself the maker; another for a process which it is intended shall be used by others, to whom he would grant licenses for that purpose. For instance, I may be in a particular trade, and take out a patent applicable to that trade; or I may not be a tradesman, and then I should take out my patent for the purpose of licensing tradesmen. I mention this only to show, that to comprehend the use of the patent law, we must have a view to both these cases, otherwise we shall not be likely to come to the necessary conclusions. These patents also are divided into different subjects, mechanical, chemical, and chemical and mechanical united. It has been stated that patents may be multiplied to too great an extent; I conceive that idea arises from this circumstance only, that as the law is not clear with regard to patents, so many are obtained that appear defective in law, which by confusing workmen really do mischief; but if the law be made so clear and defined that a patent for a something really useful, when taken out, would be found to be secure, then I cannot conceive that we can have too many patents, as they are the reward of men's ingenuity. One man has a property in the funds, another in land, a third man in the powers of his head, evidenced by his inventions; and I conceive that if you were to attempt to limit the number, you would at once cramp men's ingenuity, and not give those who are clever their fair value in the market, because their brains are the only property which they possess. I will first state the difficulties which appear to arise on the taking out of a patent. There is nothing more common, than that two persons of similar habits and pursuits should be thinking of the same thing at the same time, and it at once becomes a race between them, as the law at present stands; as the moment that one is known to be soliciting a patent, the other man uses every means in his power to discover what the other person is about, that the first may not clash with his; and if he is a dishonest man, and finds that his own is not good, that he may so oppose the other as to render that of the first person useless, unless he will agree to allow him to become a participator with him by making it a joint patent. But that is not the only difficulty in which he is put at

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present; there is that of intitling his patent in such a way as that other persons, not then thinking of a patent, may not be by it induced to do so; or that others, who know the value of a patent for such a subject, may not set their brains at work to endeavour to obtain one also. That circumstance happens to be within my own knowledge at this moment; there is a great want of a certain something at this moment in a particular kind of business, a friend of mine has discovered the thing required, and I am quite satisfied, from knowing exactly what he is about, for he first set about it at my request, that he could go for a patent, and that the patent would be very valuable. I also know another person, with whom I am well acquainted, who being in the trade, is aware of that necessity as much as myself, and I feel satisfied that if my first friend were to go for his patent, the second, without meaning at all to do the first an injury, would be immediately set at work, and would at once know, from his knowledge of the subject, what the other man must be about, and they would come in collision; and therefore the only probable remedy at this moment would be to bring the two parties amicably together. I would exemplify this also by another circumstance of the same sort, where a person was absolutely soliciting a patent; a friend of that person informed me of it where a party were assembled in this city. I was surprized at what he stated, because it appeared to me almost next to impossible that the end stated to be sought for could be obtained. I told the party that I would endeavour to find it out, and that if I did, I would come to them and inform them of what I had done; and I came back on the day I had promised, and told the party that I had accomplished my object. The person who first mentioned it to me, asked if I had any objection to allow a third person to be the umpire between us; on condition, that if our ideas were the same, we might unite our forces, but that if our ideas were different, each might still proceed. I agreed, but I did not meet the other man, but the third person who was to be the umpire only; and when we had both stated to him our ideas, they were so perfectly unlike, though attaining the same object, that we both took out patents. That patent I have never used, but it is at this moment in existence; they were patents for making gas-holders capable of containing a double quantity, when compared with their usual contents. In further illustration of what I have said respecting different men pursuing the same object, another patent came within my own knowledge, where a friend of mine and myself were concerned. We believed a great object was to be gained by a peculiar process in a trade of great moment, and I took a great deal of pains whilst I was travelling in different parts of England, to ascertain whether it would be so or not, and whether such was known. We did not conceive that any person had ever thought of the same thing. Nothing had ever transpired publicly as to such belief, but when I returned to London, a friend told me that he thought a person had been taking out a patent very similar to it, and referred me to the brother of the patentee, who referred me at once to the specification, and I found that we had both been travelling exactly to the same point and by the same road; and although the process has not as yet been used, I am quite sure it will be found a very valuable discovery. This, then, will assist in accounting for the cause of our having heard so much of persons giving titles to their patents which do not at first sight appear to convey the real meaning of that for which they ultimately specify. It is not for the purpose of improper deception, but it is because the law so stands at present, that if they do not so guard themselves they are liable to be imposed upon, and to have all the benefit of that invention which has been the fruit of a vast number of years consideration, in one moment swept away from them.

Can you suggest any remedy for these inconveniencies?—I should conceive, from all the difficulties that have occurred to myself, and to the friends I have been acquainted with, that the best remedy would be what has been recommended by other witnesses, namely, that the inventor should be secured, under such conditions as shall hereafter be thought right, from the time he makes his first affidavit, so that other parties may not have the opportunity of availing themselves of his first discovery of his invention to the public. This opens another circumstance worthy of the consideration of the Committee before they make their Report on the specification, because it to a certain degree alters the state in which a person is placed; I conceive that if the patentee could be secured from the time of his petition, he might, as regards his monopoly, be allowed any time he pleased to specify, provided his patent bears date from the sealing, that is, as between him and the public, as he would still have only his fourteen years, and these running from the period when his patent is sealed. If he required a longer time to specify, from any thing particular,

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particular, the public would be no losers by that, inasmuch as the specification is a part that is of no importance to any body but himself, if the law really secures his invention to him till his fourteen years has expired. As the length of the time occupied by him in his experiments is a loss to himself only of that portion of the monopoly, and it is therefore not a question as between him and the public on that head, that can in the slightest degree affect the public; the only way it can affect them, is in preventing others from proceeding with other patents, fearing that they may run upon the road which he has already taken; therefore a limit on that account would be required, and the question would ultimately be, to what time that limit should, under such circumstances, be confined. The next point to which I would go, is the difficulty under which patentees appear to me to labour after patents are obtained. The first which strikes me is the ease with which valuable patents may be defeated, through the ignorance (I mean mechanical and chemical ignorance) of both Judges and juries, who with the very best intentions in the world to do justice as between the parties, yet not being fully aware of the value of the minutiae of those peculiar subjects, will get the contending parties into greater difficulties than those in which they originally started; and this is greatly felt at present from that spirit of attack which is now so constantly exercised against the patentees, urged on by this particular fact, that the public, or the parties attacking the patentee, have every thing to gain and nothing to lose by it, whilst the unhappy patentee has every thing to lose, and by no possibility any thing whatever to gain by it. It is a circumstance well known to those who have been in the habit of taking out patents, or have given their minds to mechanical subjects, that whenever a patent for a valuable invention is taken out, there are persons who immediately try by every means in their power to gain all the advantages to which the patentee is entitled, by studying how he may avoid in some way or other the specification, for by getting through that instrument a perfect knowledge of the process, he becomes perfectly acquainted with the views of the original inventor, and then endeavours, through some other mode as yet not practised, to avoid the specification, giving to his mind a view of the subject which he never would have thought of, if the original inventor had not first obtained the monopoly which, on specifying, the patent gives him; and it is not at all considered, I am sorry to say, by many persons in the slightest degree dishonest to do every thing in their power to defeat a patentee, after he has obtained his grant. This has occurred to myself in a most extraordinary way, and not confined at all to mechanical persons, but extending to others in no degree connected either with science or mechanics, but who seem to have taken up the same idea, viz. "that a patent is fair plunder." I would instance one set of persons, who first of all agreed to take a license for the use of the patent process, and after having so done, whereby we conceived that they had acknowledged our right in it, they set us at arms length, and used it; drove us into Chancery to open their door to see what they were doing; that is, to obtain legal proof of it, and then into court after we had obtained that proof; and the night before we were to come to trial, compromised and took a license from us. Another party after this, conspired with three or four other set of men, dared us to the proof, and denied that they were using it. We were then obliged to go again to Chancery; but they consented to allow us to inspect. Upon inspection by a third person, we found they were using our process; they continued to use it, and defied us; we had then no remedy but to charge them with this in Chancery, and to oblige them to come in and answer for themselves; one of these companies denied that it was a patent, or that they knew it was a patent, although the company was established on this basis; and they would not have obtained the power of becoming a company at the time they did so, if the patentee had not discovered his process; he came to London for them, and was ready to attend a Committee of the House, and to give proof of his invention; but they allowed a clause to go into the Bill, which compelled them to adopt this or a similar description of process, and they had paid him for the trouble he had taken, and for his journey to town upon it. In company with those, were two other large and powerful companies, from one of which a deputation had waited on the patentee long anterior to the time when we discovered they were using it; they had acknowledged the value of the process; we had a letter in our briefs from themselves, requesting to know the terms upon which we would license them. We visited their own place, we saw they never had used it, and they abstained from using it at that time, because they could not come to terms with us; they let a short period go over, and then used it privately;

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denied that they were doing it, and ultimately joined the other party in opposing us. They were at last, however, obliged to appear in Chancery by affidavit; and then the whole of these conspiring parties attempted to bolster their case, by bringing persons to swear by affidavit that the thing had been used before any of those negotiations or communications had taken place. It fortunately, however, happened for us, that we had anticipated the principal evidence, and expecting where he might state he had used it, as having been employed there anterior to our patent, we applied to the party who had employed him, and we had an affidavit from that person, stating that there never had been any process similar to ours used in his house; so that when the affidavit of this man was produced, it was at once refuted; because, fortunately for us, he stated that he had used it at the very house with respect to which the owner (a most respectable person, and perfectly free from any connection with any of the parties) had already given us the directly opposite proof; it also fortunately happened that this man had published a book, in which he stated all the inventions that he had made; and it bore date subsequently to the patent of my friend, and when his process was well known; and although this witness swore that he had so used it, when we searched his book we found he did not say a word about it; though he begins by stating that he would give an account of all his inventions. This case was of so much consequence, that we employed four counsel in Chancery: we had consultations, and every thing that could be necessary for a case of the greatest importance. We appeared in court for a decision upon whether or not an injunction should be confirmed restraining those parties; a compromise was proposed; we consulted our counsel, and although we knew that they had the strongest case upon affidavit that they ever saw, and where this peculiarity attached, that if those who had sworn on our side had said a single word wrong, there were, I will venture to state, hundreds of persons who could have denied us, and yet not *one* did; still so uncertain did the counsel consider the view that the court might take of the case, that they advised it, as the more prudent course on our part, even then to come to a compromise, on their all taking licenses; and under their advice we did so with all the parties who had thus conspired against us: but this did not rescue us from attacks; for at this time five or six other companies are again conspired together to endeavour to defeat us, although we have granted licenses to at least fifty different sets of people, and the patent has but two years to run: so that I would venture to make this remark, that, situated as the law is at present, and with such a state of society as I have described, patents may be rendered next to useless, (however good they may be,) by the constant attacks that can be made upon the patentee, supported as these attacks now can be by such evidence as it is in the power of almost any man occasionally to obtain.

Can you suggest any remedy for the evil you have described?—It appears to me, that the best remedy that the law of the country, as far as I understand the law, would at present offer, would be this, that after a person has publicly used his patent for any given number of years, (say five if you please,) and no one has thought it worth his while to bring a *scire facias* against him, on the score of its not being a novelty, or having been used before, and therefore not a fit subject for a patent, whilst he has himself attacked (thereby showing his disposition) those who have endeavoured to pirate his invention, although compromises may have taken place between him and other parties, the patent should be deemed good and valid, and that an injunction should issue against all future aggressors, which should not be dissolved, the same as if his patent had been proved valid in court. I conceive that the King having granted a patent, the law should originally presume that that patent is a good one, and that the onus should be on others who believe it bad, to repeal it by *scire facias*, within a given time; it should not rest on the patentee to be eternally driven to bring action after action, and to be harrassed to the very end of his patent. My reason for stating this is, that if you consult counsel upon such a subject, you will be told, as we were very properly told, you may safely compromise, as it will be clear to the world, that if the parties against whom you bring your action compromise with you and take a license, that the other party found themselves in error; so we fancied, but the truth was not so; others attacked us in the same manner, and then when we had to consult counsel upon our second case; they said, although in the former case you could not try for an *ex parte* injunction, we think now, after having first gone into Chancery, and then into court, and the parties compromised with you, taking your license, that will be sufficient proof after so many years of use, that we have very little doubt but that the court will,

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will, upon your showing that all those things have taken place, and that you have, during eight years, used all due diligence to bring those you could detect to account, but that the court will confirm an *ex parte* injunction; but the result really was, that they themselves deemed it afterwards prudent in court to advise us again to compromise upon the parties all taking our license to use; and again we were left in the tenth year in the same situation that we were in the very first day we started; I conceive therefore, that if after any given time in which persons have allowed the patentee to work upon his specification, and have not within that given time thought it worth their attention to show that his patent was not originally good by moving a *scire facias* against him, that after that period the patent should stand good, provided you could prove that you had used all due diligence to prevent every one from working upon your process, with whose conduct you could be proved to be acquainted. It was proposed to the Committee, to preserve the patentee against the description of evidence which I have mentioned, not to permit any evidence to be given of its having been used before a certain time anterior to the sealing of the patent, and that parties should not have the power of going back to any indefinite period they please, when it would, from length of time, be impossible to get evidence to rebut it; leaving the proof of prior use, as at present, on the word of one man; by which any patent can be so defeated; because it was stated, and with much justice, as my experience teaches me, that nothing is more common than to find persons who will come into court and swear that they have so used a certain process, and such swearing will defeat a patent, although no collateral circumstance is adduced that can confirm it, the court feeling itself bound to rely upon the bare oath of a solitary individual. With regard to another proposition which was made, and which I have considered, as to the circumstance to which I am now referring, namely, whether a proof of prior use should be allowed beyond a certain number of years, anterior to the sealing of a patent; that seems to have been the policy of the French law, as evidenced by a very strong fact, namely, that a patent taken out and neglected to be used only for two years, shall so perfectly destroy it, in consequence of the neglect of the first person, that another person may take it out again, and it shall be good against all the world. In proof of this, I can state that a friend of mine, with whom I was interested, took out a patent in France; it was necessary, under this law, to use it within two years; this he had no means or even view of doing himself, but to license the use to persons resident in France, a treaty was entered into with a man there; circumstances, which he could not control, prevented him from coming to an immediate conclusion; the parties with whom he was treating kept putting him off from time to time, after his having placed one of his machines in the hands of a banker, who was also a gold and silver wire-drawer; the patent was for drawing wire through holes made of *jewels*. The treaty was continued till the two years were run out; he then went over, when he was told the treaty was at an end, that he had never used it, and that his patent was forfeited. Upon closer investigation, he found that the moment he had placed the jewelled hole in the hands of the banker, he had sent it to Geneva, where an ingenious workman, who had been in the habit of perforating holes in jewels for watches, was employed to make a set, which they had found completely answered the purpose; and he learned, to his annoyance, although he had been offered 10,000*l.* for it, this banker had then, by this stratagem, availed himself of the law of forfeiture, by keeping it out of use; that he had taken out a patent for five years, had given the holes to his workmen at Lyons, and having established the use, had so reduced the labour, that he obliged the workmen to labour at two thirds of their former prices, thus reaping the reward of his infamy, the extent of which is inconceivable, where they draw wire for almost the whole of the continent for making gold and silver lace. I conceive, however, that so far as regards the period of two years, the facts I have stated have shown the badness of the law; because if a patent was to be forfeited in this country for nonuser at two years from its date, that is from the sealing, no person would like to take out a patent that he did not himself work, because a third person taking out a patent for the most ingenious thing in the world, could be defeated, by the people in the trade refusing to work upon it until the expiration of the two years, when the thing would of necessity become public; but I conceive if it were lengthened to five years, that would very much alter the case. I merely throw this out by way of showing how the thing is done elsewhere, and what might be its operation.

What is your opinion with respect to allowing patents to be taken out for a principle?—With regard to patents for a principle, from the evidence which has appeared

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before us, and from what I myself have previously understood upon matters of this sort, there is great difficulty, from different cases which have appeared to be ruled as for a principle, while I believe the law to be, that a principle cannot be patented unless it is reduced to practice. It was suggested by one of the witnesses that the law should be settled one way or the other, and he seemed to advise rather that principles should be allowed to be a ground for taking out a patent; but if it is to be ruled on one side or the other, I conceive that it would be wiser to say that the word "principle" never should appear at all in the case, and that the Judges should be bound by an absolute practical process, without at all inquiring upon what principle it is, but whether the thing done be a new and entire fact, and one worthy of a monopoly. As the word principle throws it into confusion on one side or the other, as I conceive such cannot be patented without an effect or process being produced upon the principle, it would do better to avoid the word principle altogether, and say that the fact or process specified shall be the thing that shall be secured. I will exemplify the patent with regard to shearing cloth. There it was held that no man afterwards should shear from list to list, because that was the *principle* of the original patent; but if another man can shear from list to list by a process perfectly distinct from any which the first man has described in his specification, I do not see why the second person's ingenuity is not to be equally rewarded; for if that man in specifying originally, conceived that it could be done by more than by the plans specified, he would have embraced them all; and at all events I feel, that taking the great bulk of patentees, you may put the patent law into a shape that would do more real good by excluding principle, than by admitting principle to be taken into consideration. One of the witnesses stated that Bolton and Watt's, patent was for a principle; he was asked what that principle was, and he said he had not sufficient time to consider. I imagine that the ground upon which that patent was taken out, would rather be against the case of establishing a principle than otherwise. The only difference between Bolton and Watt's engine and those which had been used before, was this; that those engines that had been used before, condensed in the cylinder, and consequently cooled the cylinder at every stroke. Bolton and Watt considered that a great saving both of time and of fuel would be gained, if they were not to condense in the cylinder and cool it at each stroke, because certain portions of steam were naturally lost in again getting up the proper heat of the cylinder; they therefore contrived a second vessel, called the condenser, communicating by a pipe with the cylinder, a jet of cold water being let into the condenser; so, being a separate vessel, the moment the steam is condensed in that, it creates a vacuum, so that the remainder of the steam continues to rush in and fill it up, till the whole becomes a vacuum, from the vessel in which the condensation takes place, to the most distant part in the cylinder, and does not tend to cool the cylinder as in the former instance. If there was a new principle, that principle only could be from the want of prior knowledge at that time, that if you made a vacuum in one vessel, and there was a hole communicating with another chamber, the steam would rush in to fill up that vacuum, which I conceive to be a principle perfectly known before, and that therefore the engine was not a new principle, but the new application of a known principle to a new purpose. It is supposed that Bolton and Watt's patented a principle, when they took out a patent for their steam engine; I believe they only patented a method of applying an old principle to a new engine.

Do you think that the specification should be allowed in any instances to be concealed?—I conceive there may be times when a concealed specification can be of value to the patentee, and at the same time not an injury to the public; and that when witnesses have been asked as to what would be the effect of a concealed specification, they have been led into a difficulty, and unable to give the Committee satisfaction upon it, because they have not considered what would be the state of a patent under such new circumstance. Men speak frequently of the uselessness of a concealed specification, because they could not defend their patent without bringing it into court, and that, therefore, their own objects would be defeated by the first man who pirates them. And it is also asked, Would it not be the means of permitting other persons to work innocently upon the same plan which they have already patented, and thus bring those persons into difficulties with the patentee, when he should discover the process they were using? There is no doubt, and that the latter would at first sight appear to be the fact. But it would be a matter of policy, and worthy the consideration of the patentee, whether or not he would attack such party, and thereby open his specification; and whether he would not rather let such man continue to work, provided that man took due diligence to keep his

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his mode concealed from the public: and the reason why I mention this is, that I know there are persons that have made valuable discoveries, and are now working secretly upon them, preferring to trust to concealment rather than have a specification which will enable other persons, anxious to run on the same road, to discover the process by which they themselves are working. I do not feel that any other person would be put to any hazard, provided the same justice was given to both parties as is already attempted to be given with regard to all other alterations of the law; because, supposing a patentee had this advantage given to him, a condition should be imposed upon him, that any man who worked upon the same process during the time he kept his specification concealed, should be allowed to continue that work till the end of that patent, free of any charge from the original patentee; and that the patentee should have an action at law only against such persons (as is at present the case) who should use his process after he had made his specification known. I state this in consequence of believing, that it would be in many instances much more valuable to a manufacturer to allow even a second and a third man to work, provided they put their heads together and concealed the process from the public at large, than to throw it open, and to leave the whole world to pirate and destroy him, as is at present the case. This could only be of value on certain descriptions of patents, to which I have originally referred, namely, those which are used by the manufacturer himself, and not those of which profit alone is to be made by licensing them to third persons. I would under no circumstances therefore say, that all specifications should be concealed from the public; but I cannot but believe, that it would be advantageous in many instances if a man could have the power of getting it concealed during such period as he might think to his own advantage to keep it so.

Have you ever known that patents have been licensed to some individuals, and that the patentees having fixed upon the terms upon which licenses might be fairly granted, have refused to grant them to other parties?—It has never come within my own knowledge.

Have you ever known cases in which any sort of arrangement has been made between the patentee and the party to whom it has been let, that it should not be let to other people?—It has been proposed to me, but I have never acceded to it. I have heard it questioned by a lawyer, whether it would not be contrary to law.

In the observations you have made, with reference to keeping a specification concealed, you have not adverted to one inconvenience which it has been stated would arise to the public from not knowing what the patent is granted for, so precisely that persons might not engage in discovering inventions which have already been patented?—I think that inconvenience could not happen, because I have already stated that no man running the same course should be liable to any action for so working, so long as the patentee thought it fit to keep his specification concealed.

Are there not cases in which a patent could not be adequately protected without allowing it to be taken out for a principle? take, for example, the case mentioned by Mr. Rotch in his evidence, of a wash being exposed as a shower to the action of heat?—I presume that any man who has ingenuity enough to invent what is considered a new principle, could only do it through his knowledge of the wants of different manufacturers of an improved process in their business, which process he has applied his mind to accomplish; and that the same mind that would see it fitting in one way, would, before he specified, take the whole range of mechanical means by which that could be accomplished, and that he would be fairly entitled to specify for all those means, and that these would hold good for all the different manufactures to which they could be applied; that he would have a fair right to specify for all such manufactures; and as to those which did not then exist, or of which he had at the moment no knowledge, that to those he would not be entitled to any right, for he would have given nothing to the public as an inducement.

You conceive that a person who has made an invention could foresee all the means by which that invention could be used?—I do conceive so; that is, all the means that are usually known in mechanics, and are in practice.

You have said that patents are sometimes infringed by introducing some slight alteration in an invention, so as to avoid trenching upon the specification?—Yes; but by alteration I mean another road, suggested by knowing the first: a slight alteration would not give the second man a patent, but it might suggest to the second man another road, which at once defeats the value of that which has taken the first man years to accomplish.

You have stated that the presumption should be in favour of the patentee; do

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you think that presumption should be raised, while the present loose mode of granting patents continues?—I should say always in favour of the patentee; because it is the only reward for his ingenuity, and he is one man against all the world.

You are aware that a patent is granted now without any examination on the part of the Attorney General, unless it is opposed?—Truly; but the best security you can get in this day that a patent will not be taken out, unless the party thinks it is good for something, is the expense; I do not presume that that description of man who is in the habit of taking out a patent would go to that expense, unless he had, he believed, a profitable end to gain by it.

Veneris, 5^o die Junii, 1829.

Benjamin Rotch, again called in; and Examined.

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YOU proposed giving the Committee some more evidence?—It was only on one subject more I proposed to give any evidence upon, except it might be elicited by questions; it was merely on the subject of invalidating a patent because any one trifling thing in it happened not to be new; and the case that is perhaps the strongest case in point upon the subject, is the case of the chain cable. There was a trifling thing connected with the anchor introduced into that patent, and though the chain cable itself was of special importance, the patent was upset because something connected with the anchor was introduced into the patent which was proved not to be new. I should think it was extremely desirable some provision should be made for the public to have the use of that which is not new in the patent, but that still the patentee should have the benefit of what remained; this, of course, would open a door to patentees making experiments with the public feeling; they had not the responsibility they have now, and which is a very useful check if they did put in any thing old. They would try experiments, and to guard as much as possible against this, I have one suggestion I wish to lay before the Committee, and that is, if any thing should be found in the patent that is old, *a certain portion of the term* should be forfeited thereby, merely as a check upon the patentees; whatever that portion may be, may be a matter to be filled up afterwards, if the suggestion was thought worthy of notice; and having stated that, I have no further suggestions to volunteer than what will be found upon the notes of the evidence I have already given.

Will you have the goodness to describe how they brought in something about an anchor in a patent for a chain cable?—I really forget; I do not recollect the patent sufficiently to state what it was.

From your experience, do you find there is much uncertainty in the opinion of Judges as to the law of patents?—Very great, insomuch so that it is constantly advised by barristers, withdraw your record to day, because such a Judge sits for such an one who is ill; withdraw your record; they do not dare to try it; and if a country cause is going to be tried, why did not you lay your venue in Middlesex, before Lord Tenterden, who takes a very liberal view of patents; why did you lay the venue in the country, to try it before a Judge who has a very contrary feeling? The whole I have submitted to the Committee was with a view to establish a certainty, and not to admit of this fluctuation; because, my own knowledge tells me, there are hundreds of patents that might be brought out, but which people will not bring out; first, from the difficulty of sustaining the patent; and, secondly, because if they go to the expense of machinery, and complete the manufacture without a patent, they get nothing by it, because their neighbours do the same immediately, and there is no inducement for private individuals to bring them forward: if a large manufacturer does it, it may be an advantage to the general body, but not to himself particularly; but you do not get individuals often to look so far as that; the expense being great, unless they can *recoup* themselves, they do not think it worth while to bring it forward; but certainly the greatest point is the indecision of the Judges in deciding what is the object of the patent, because it is generally on the wording of the title of the patent with regard to the specification that patents are upset on the specification, and it is not one time in ten that the patent is upset on the specification, merely because it does not describe the invention in a way that will enable a workman of common ability to execute it; but the grand difficulty is the uncertainty of the opinion of the Judges as to what is the subject

subject of a patent, in fact, what is the meaning of the word manufacture; and I think, after the reference made to Lord Tenterden's opinion, nothing can show more completely how much they are at sea upon the subject; where a Judge says, it is often taken to mean so-and-so, and may extend to so-and-so; those words are quite distressing to advocates, they do not know how to advise.

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Does not it follow, you are very frequently in the habit of advising a compromise where it is offered; where it would be much better if the Judge and the jury understood the thing, not to compromise at all?—Very often, indeed.

Are you aware of any cases where persons have compromised upon any understanding in the trade, so as to restrain the use from other parties?—Frequently.

Can you mention any cases?—No, I cannot; it will be a sort of breach of professional confidence to mention the cases that have come before me by name.

Mr. John Isaac Hawkins called in; and Examined.

Mr.
J. I. Hawkins.

ARE you acquainted with the law in Austria as to granting patents?—I have a copy of it.

Will you be so good as to put it in?—[*The witness delivered in the same, which was read. Vide Appendix (F.)* I will also put in a list of the number of patents taken in Austria the first six years of the existence of this patent law; it began in 1820. Here is a statement of the number of patents taken out in Austria, and in France and England, in the six years succeeding. [*The witness delivered in the same.*] See Appendix (F 1.)

Do you know any thing of the working of that law?—Very little.

What number of patents were taken out in the six years preceding the new law?—In the preceding year, 1819, from February to June, twenty-seven patents were taken out; and in the year 1815, fifty-eight; and in the succeeding year to the law coming into operation, one hundred and seven.

Have you any information to afford the Committee with respect to the patents in America?—The information I would offer is, that I published in America, thirty years ago, a view of the real nature of the law of patents, and objected to the patentee being charged anything for the expense of having his exclusive privilege secured to him; and there the whole expense at that time, and the same expense now, is 30 dollars (6*l.* 15*s.* sterling.) I found many cases where poor men had found out an invention, and spent the whole of their money in bringing the invention to perfection, to whom it was felt a grievance, and I pleaded the cause of the poor in the public papers at that time, and since my arrival in England I have not seen any reason to alter that view. It seems to me that the great bulk of inventors are poor, and that they generally expend all their means in bringing their invention to perfection, and having so expended all their means, they cannot take out a patent unless they can find a monied man to produce funds; I have frequently undertaken to bring monied men and inventors together on that score, and have rarely succeeded in bringing them together, because the inventor is afraid to disclose his invention for fear of losing it; and the monied man is afraid to embark any money in it, because he cannot know the invention, and the negociation has generally failed on that ground.

Is it not commonly known among men of science, commonly considered as almost a proverb, that few men who are patentees ever reap the advantage of their own ingenuity?—I consider it almost proverbial; and I consider the expense of the patent is one cause of that state of things; I conceive the consequence of charging any considerable sum for patents is, that none but bold speculators take a patent, and hence it is that so few prove profitable; and my view is also, if patents were given free of cost, the public would be benefited by the inventions of the cautious and sober-minded, and thus a source of permanent wealth to the country would be opened. I am well acquainted with many cases in which a poor inventor has remained poor, while the capitalist has realized a great fortune by the invention, because the invention could not, before being patented, be shown to persons competent to judge of its value. I have been for more than thirty years in the habit of being consulted confidentially by inventors in England, France, America and Austria, and I have prevented a great number of patents being taken in England and France, by laying before the parties the difficulties they would be likely to meet with, in negotiating with men of capital prior to taking a patent. I firmly believe

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believe I am, at the present moment, the confidential depository of important inventions, which, if they could be patented free of cost, and thus become marketable commodities, they would immediately occasion employment to thousands of people, and I have no doubt many other engineers could say the same. I know of several instances of valuable inventions having been lost to the public by the death of the inventors, when if the parties could have been made secure, they would have treated with capitalists, and the inventions probably have become important staple articles of manufacture. Within these two hours I have been consulted upon the subject of a rotatory steam engine; the inventor has kept it to himself forty years, and has not shown it to more than one or two persons; I was consulted by a capitalist, a gentleman who will advance the money for the patent, if I will give a favourable opinion of it when I see it, and I am to see it to-day. Having extensive acquaintance with men of invention and men of capital, I undertook many years ago to act as agent between the two classes, but was very rarely able to bring the negotiation to a satisfactory conclusion, principally owing to the costs of the patent; and indeed I do not recollect that I ever succeeded in such a negotiation, without taking upon myself the serious responsibility of recommending the invention, which recommendation common prudence generally hindered my giving, even when I thought highly of the invention; and finding, from much vexatious experience, that such negotiations tend only to waste the time of all parties, I have for some time declined attempting to bring capitalists and inventors together. I would propose patents to be put upon the same footing as copyrights, or rather as statutory; there is an Act for the protection of artists in forming statutory. I would just draw a parallel between an artist and an inventor: if I take a piece of clay, and model the likeness of a human head, or any other form that my fancy may dictate, and cast a copy of the same in plaister of Paris, I have a patent or exclusive right to sell copies of it, by merely putting my name and date of publication upon each copy; but if I take the same piece of clay, and spend the same time on it, and model a useful article, a tea-pot for instance, and cast it in metal, I must pay from 100*l.* to 400*l.* for a patent for that article, which I consider a hardship. I would propose that the publication of any new discovery should constitute the evidence of exclusive right, and that the publication should consist in sending to certain offices written or printed copies of the specification, attested by the signature of the inventor, and also advertising for sale copies of the same for a reasonable price, in a certain number of newspapers; and I would argue, that the placing patents on that footing would tend to prevent monopoly, by opening a wide door to competition. It is apprehended by some, that the great increase in the number of patents which would be the consequence of throwing off all the fees, would occasion so much litigation as to become a great public inconvenience; my view is, that this evil, if it should be found to exist in the early stage of the change, would soon correct itself, because every trial of a patent cause would tend to enlighten the public mind, and enable persons to decide many critical points without an appeal to a court of law; it is very probable, that more litigation would be generated by the increase of a thousand ships employed in commerce, than the increase of a thousand patents; but who would imagine that an addition of a thousand ships employed in the commerce of the country would be a public inconvenience? My argument would go to show, that a great increase of litigation would not be likely to take place, from the reason I have given; and that numerous disputed rights to inventions are, and would be continued to be settled by the knowledge of the parties themselves, or by the explanation of scientific friends and others, and a small portion only would come into court, as containing points of great difficulty. I would wish to give my opinion, that the greatest encouragement ought to be given to every species of invention. Should difficulties on the score of vested rights in fees, prevent exclusive privileges free of cost, the Austrian patent law may afford a model for raising a sufficient sum for compensating the possessors of such rights, without much oppressing the poor inventor. The whole costs of a patent in the Austrian empire, including a population of thirty-two millions, is 42*l.* 10*s.* for fifteen years, which is paid by annual instalments, beginning with 1*l.* a-year for five years, then rising ten shillings a year, and ending with 6*l.* for the fifteenth year.

Have you turned your attention at all to the difficulties arising from disputes upon patents?—I have had a good deal of experience, and been in court very often.

Do you consider that the patent system is ill adapted for decision?—Yes, because juries are generally totally ignorant upon the subject: if a special jury of men conversant with the subject was summoned, I should conceive the present system

system might be preferable to any board of commissioners; it would give more public satisfaction than any board of commissioners.

Is not a special jury necessarily a very expensive mode?—It increases the expense not a great deal; if it is a chemical patent it should be a jury of chemists.

Could you suggest any mode of getting a jury of that character in such cases?—I do not know that I could.

Did you ever consider the project of a commission?—Yes, I have considered it, and I think it attended with very great difficulty; I do not see how a commission can give satisfaction.

You think there would be too much jealousy?—It would be difficult to find commissioners who were not, some how or another, connected with the manufacture of the article that might come before them.

Might not the same objection apply to a jury; is it not probable that the persons selected would be interested in some way, or have a preconceived opinion upon the subject?—It would not apply so strongly as to a commission; in a commission there would not be not be more than five persons, perhaps; and upon the jury there would be twelve, and there would be less objection.

Would you have an equal objection to a commission, supposing the parties had the power of challenge?—Not so much in that case.

Do you think it would be possible to bring parties together to any scheme of arbitration?—I should think that arbitration would be better than a commission.

Do you think you could bring parties together before an arbitration?—It is now frequently done; I know of several patent questions settled by arbitration, and by the modern mode of arbitration much time is saved; it used to be that each party chose an arbitrator, and the two arbitrators met together and canvassed the subject; each arbitrator pulling to an opposite point, until they became two enemies. I have seen that repeatedly, and in that state of the case a third is chosen as an umpire, then all the arguments are to be gone over again by those two arbitrators as counsel, and the umpire as judge; the modern practice is an improvement upon that, as the third arbitrator is chosen before any discussion takes place, and the three arbitrators meet and hear the question at once; each of the arbitrators are judges, and they do not mix up their own passions in the thing, and decisions are come to much pleasanter by the three arbitrators at once.

You stated you objected to a commission; will you state what your view of a commission is to which you do object?—A set of men appointed, say five gentlemen appointed as a commission to judge of patents generally.

What would be your idea of five persons, men of science, being appointed to act both as jury and judge, constituting a court, and having before them the evidence brought in the same legal way, with advocates on either side as at present in court?—Provided such a commission were open to challenge, I should conceive that it would be a very useful mode of proceeding.

The question assumes that persons might be found above challenge for this commission; do you not believe such men could be found?—Yes, but I should doubt whether such men would, in the opinion of the losing parties, be above suspicion.

They would not be worse off than with the Judges now, by your own act?—No.

He is considered, in many instances, incompetent for a mechanical or chemical subject?—Yes, he is.

Do you think, if the court had the power of ordering arbitration, it would be satisfactory to parties to have their cause so settled?—That is generally more satisfactory than the verdict of a jury.

At present the arbitration can only be by consent?—Yes, certainly.

Supposing the court ordered it, do you think it could be managed?—Yes, I think it would be tolerably satisfactory to the great bulk of persons.

Would you be inclined, in that case, to leave to the Judge the power of selecting the arbitrators?—I think that that would not be likely to give satisfaction, unless there was some degree of choice, because the losing party would say the Judge did not know, he appointed such a man of course.

Supposing they were made liable to challenge?—If they were made liable to challenge it might answer the purpose.

You think, in that case, the parties would be likely to agree?—Yes, they would be satisfied they had justice done them.

You were giving the Committee some information as to the American law, are

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you aware whether it is the practice there to lodge models of the inventions in the patent office?—It is not absolutely necessary, it is desired, and they rather favour the lodging of models; but the law does not render it absolutely necessary.

Supposing that part of the American system were introduced into this country, do you think inventors would frequently avail themselves of the power of lodging models in any public office for the purpose of an easy determination of disputes?—I should think a great number of models would be lodged; but I do not conceive it possible to oblige them to lodge models, because some things are not capable of being shown by model.

Do you not suppose it would conduce very much to the easy determination of disputes arising upon those questions?—Very much.

Would it not lead very much to piracy?—It might, in some degree.

Are the specifications sealed now in America?—No.

Where they under the old law?—Yes, in 1790.

Do you know how it worked?—Very disadvantageously.

Can you state how?—The public were not able to know whether a person had a patent or not; a man asserted he had a patent, and there were no means of knowing whether he had or not; a great deal of unfair practice was suspected, but could not be proved.

Do you remember any case of a man working upon another's patent, and what was the result?—I have known a patent worked under a concealed specification; another person has also worked against the patent, and the patentee has determined not to go into court on the subject, and has suffered the infringement because he would not have his specification unsealed.

Is the law of patents the same in all the States in America?—Yes, it is one law in all the States.

One law includes the whole?—Yes; there is one point as to the time of lodging the specifications. I should conceive, for various reasons, the specification should be the first thing, as I believe it is in all countries except England; in America the specification is the first thing presented; also in Austria, France and Holland.

Does it completely detail the invention?—A perfect description of the invention.

Would you not allow the inventor to amend his specification?—That is allowed in all those countries.

Is the specification made out at the time of the application?—Yes, at the time of the application in all countries but England. I have assisted a number of the inventors in preparing their specifications, and I have found that an inventor, as soon as he has his first idea, if he has money, runs away and takes his patent out under a general title, and when he comes to specify, he has only a parcel of crude ideas, which it is most difficult to form together to meet his title.

The Committee have been told, it would be exceedingly difficult to form a specification upon the first application?—If you force the inventor to give a specification, he must give due consideration to the whole of his scheme in order to be able to describe it, and you will then have much more perfect inventions than you have now; when you give him time to prepare a specification, he will perfect his ideas before he embarks his money.

You do not think any great inconvenience would accrue to an inventor from being compelled to make out his specification on his first application?—No, I think it would be conferring great benefit in compelling him to perfect his specification.

You would allow him to amend after the delivery of his specification?—Yes.

Not after taking out the patent?—Yes, at any period of the term, but not to lengthen his term by so doing; the same as in France and Austria, they can add to their patents at any time, but the term is not prolonged by it; it might be a serious consideration whether the specification should be published so soon, before every thing is completed.

Are you in favour of having the specification always open?—Yes, always; I found great complaints in Austria. I have been during the last eighteen months in Vienna, and I found great complaints on account of sealed specifications; it is felt as a grievance there now; by mixing with scientific people, I found it continually spoken of as a grievance.

In what way?—They cannot know whether a man has a patent or not; a man asserts he has a patent; he has a patent for something under the name and title as published, but the public have no means of knowing, except by instituting a suit.

What

What would be the result of that suit in Austria, if it was found a person was actually working upon a specification of a patentee?—I do not know the penalty attached.

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What has been the result of any one who has been so prosecuted?—I do not recollect.

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Arthur Howe Holdsworth, Esquire, a Member of the Committee; Examined.

A. H. Holdsworth,
Esq. M. P.

DO you know of any case that has been compromised on an agreement to prevent third persons from working?—I remember, some years since, when at Worcester, to have been shown the factory of a person who was making patent net; I had never before seen the thing in progress, and was rather inquisitive of the man as to its details; he told me he was working upon the plan of a Mr. Heathcoat. I asked him upon what terms they worked; he said, "we pay so much per frame." I said, I thought there had been an action brought upon the subject, and that Mr. Heathcoat's patent had been destroyed; he said that it was carried into court, but the case was compromised; they had no doubt that the patent would have been destroyed, but it was deemed wiser by the trade not to proceed, provided he would undertake not to license above a certain number of those frames, so that the trade might not be too much extended, and induce too great a number of hands to enter into it; and, as well as my memory furnishes me, I think it amounted to about 500.

Do you think it would be expedient to give permission to parties to lodge models at some public office?—I conceive that the only effect it would produce, would be enabling trades persons, who took out patents for some particular articles of their own manufacture, to give it publicity; I conceive, for other purposes, patentees would rather object to it, because it will afford facility to the public in discovering the mode by which the patentee effects his purpose, which never perhaps would have been thought of by such party if he had not so seen it; a very dangerous matter, as the feeling of the public at present exists with respect to patentees, which are deemed fit persons to be plundered, and which I would thus exemplify: I had occasion myself to call upon some parties who were, as I believed, pirating a patent in which I was interested; whilst we were talking upon the subject, one of the party, a man in one of the first houses in England, coolly told me that my patent was good for nothing, and that he could prove it, if we went into court, adding, as if to confirm his position, that he had already spent in one instance 10,000*l.* to destroy another man's patent; a proof, I conceive, that nothing can be more dangerous than to oblige a patentee to expose more of his specification to the public than is necessary, while such feeling with regard to patents exists; for if it required 10,000*l.* to destroy the patent, it must at least have had a pretty good title, or it could not have been so well defended as it should seem it must have been.

Lunæ, 8^o die Junii, 1829.

Mr. *John Farey*, again called in; and Examined.

WHAT papers have you brought with you?—A list of our Acts of Parliament, and decisions of courts of law, relative to royal grants by letters patent; a list of the number of English patents granted in each year since 1796, with an enumeration of a few of the most important ones; an edition of the foreign laws of patents, in the French language, and manuscript translations which I have made therefrom into English; viz. of the American, the French, the Belgian, the Austrian, and the Spanish laws. These are all the patent laws I have ever heard of except the Prussian, and the Russian law, of which last I learned something when I was in that country a few years ago, but I have not got them in writing; I think I could procure a copy before next Session. I hope I shall get official copies in the original languages to compare my translations with them; I have already obtained some such copies, and am promised others; if the Committee wish my translations to be printed, I will proceed to verify those I can.

Mr.
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What are you prepared to deliver in for printing?—The American law re-translated into English from an official French translation; the French law translated into English from the French official edition; the Belgian law translated into English from a French edition, not official; the Austrian laws and the Spanish laws trans-

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lated into English from a French edition, not official. Since I made the translations I have obtained an authentic American impression of their law, and also an official copy of the Belgian law in Dutch and French; I will verify the present manuscript of my translations by those, and such other official copies of the laws of each country as I can get before the printing. Of the Austrian and Spanish laws I have not received official copies yet; but I have no reason to doubt the correctness of the French edition from which I translated.

[*The Witness delivered in the same. See Appendix A. B. C. D. E. F. G.*]

(*Mr. Farey.*) If I may make any remark upon these laws, it is, that they are very superior to our system, and will all be useful to study as models: not to be adopted exactly for this country; but a selection of some articles (with such modifications as our different state of commerce and manufactures require,) would serve as guides for us.

The great distinction in our state compared with that of all other countries that I have visited is, the powerful means of execution that we possess, for money, materials, tools, buildings and workmen are all ready at very short notice to put a new scheme in practice. Also the very active spirit of competition and rivalry with which those extensive means are exercised; the excessive rapidity and extensive spread of new ideas, by our periodical publications; the facility of personal intercourse by travelling in public coaches, and by steam; the very expressive nature of the technical language that is in use amongst all our artizans; also the established habit that the English have, more than any other people, of associating themselves into bodies and societies to act in concert to effect a common object.

All these circumstances are the great means of our national productiveness; but under our present system of patent laws those means are unavailable, and are even rendered inimical to the interests of the inventors of new improvements; because those inventors are bound by law to work in secret, and with their own hands, until they get their patents; and they must rest all their future claims upon the merit of what they can produce within a very short time after bringing out their ideas from secrecy, and before the knowledge of the invention can be so spread, as to bring those national advantages to bear upon it, in order to give the invention practicability of execution, and that perfection which can only result from practice.

By the time that the inventor has been thus obliged to fix himself definitively, by a specification (in which no amendment can be made,) all the powerful means of execution that I have alluded to, come into activity to cultivate the new invention if it is a good one; and if in the end it happens that what was done privately by the inventor at first, under every disadvantage, is superseded by what can be done openly afterwards, by the united exertions of himself and others in a long course, under every advantage, he is condemned to lose his right, as having failed in law, if not in fact, because whatever he may afterwards do, he must be judged by his specification, without regard to his subsequent practice.

In foreign countries the means of execution are so limited and communication so slow, that the above circumstances are very different; there, almost every thing depends upon the individual and continued exertions of the inventor, who can derive but little aid from others, but in return he is not so liable to be superseded afterwards; he can often attain nearly as much perfection in private as openly; but that perfection is small, compared with what we can do here in public.

The object of our patent law should be, to encourage the inventor to devote all his means to the cultivation of his new ideas, and to bring all those national means to bear upon them, in order to advance them to that point of perfection, when the public can take them up, and carry them on with some advantage; and the law should be adapted then to encourage a free public exercise, with the reservation only, of such a tax upon that exercise, as will be enough to reward the inventor, and repay the costs of attaining the first degree of perfection. The terms of a law to fulfil such conditions, must be relative to the existing state of the public means I have alluded to. It may be farther observed that our advanced state, and facilities of practising new arts, does not dispense with the necessity of obtaining a constant accession of new inventions to exercise our activity upon. On the contrary we now require new improvements on our present state, as much as we did formerly to bring us to that state. To enable us to get good inventions, all that are offered must be allowed a fair and sufficient trial, and we must select the good from the bad, by trial alone, for the best judges of these matters cannot determine *à priori* which will turn out good, and which will fail.

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Have you any thing else to produce?—I have some notes which I have put down in writing, of opinions I have had occasion to form at various times, on detached points of patent law, but which were not called for by the questions put to me when I was examined before.

Did you write to Mr. Dyer to request him to attend this Committee?—I did, but he is in ill health, and cannot leave home.

Will you allow your letter to be produced?—I wrote to him to that effect on the 13th May; and, with permission, will read an extract from my letter, with another from his reply, which supports what I have just remarked.

“ It appears to me that there is a fundamental error in the feeling with which courts of justice take up the subject of patent rights; they assume that the patent is given solely as a reward for the disclosure of a secret invention that has been concocted by the inventor in private, before he applied for his patent, and that the right granted by the patent is only conditional on the event, that the secret when disclosed in the specification, shall prove in every respect what the inventor professed it to be, namely, that it was wholly within his own power to have disclosed or concealed it at the date of the patent, and when disclosed in the specification, that it shall, in that state, be new, ingenious and publicly useful. Upon these premises if the invention becomes known before the date of the patent, without the inventor’s act, or if, when disclosed by the specification, it is not what it ought to be, the conditional patent becomes void, and cannot be made good by any subsequent acts whatever. The propriety of making a deficient invention good after it is disclosed is not contemplated or provided for, and yet in fact it almost always happens, that the inventions which ultimately come to be of great public value, were scarcely worth any thing, in the crude state in which they emerged from secrecy; but by the subsequent application of skill, capital, and by well directed exertions of the labour of a number of inferior artisans and practitioners, the crude inventions are with great time, exertion and expense, brought to bear to the benefit of the community. The first inventor is not always a person the best qualified to go through all this process of training and establishing his own secret production in real use; but whenever that is the case, the incompetent inventor would find it to his interest to sell his crude ideas to others more qualified to put them into successful practice, if such transfer were provided for, and encouraged by law.

“ My view of the true policy of a patent law is very different: I consider that patents ought not merely to be viewed in the light of rewards for what has been done in secret before the patent is granted, but more particularly as holding out an inducement and encouragement for doing what requires to be done publicly afterwards; and insuring a competent reward for successful exertions in bringing the invention into use. I would consider the granting of a patent to be like letting out a branch of uncultivated industry on lease for a term of years, to some person who is qualified in talent, capital and activity, to work that new branch, and bring it to a system fit for common and general use amongst inferior people, who would not of themselves have had the necessary means of establishing a new and imperfect art, although they have every facility for adopting and practising an art previously brought to tolerable perfection. In chusing such a lessee of the new branch of industry, we must of necessity give the preference to him who first becomes a candidate for the lease, because it is his of right; but if the prospect of successful cultivation is so open and good, that several competitors would be willing to take the lease, we should encourage a transfer of the right of priority to that one who is best qualified to work the lease advantageously. There is every probability that he who can obtain from the first candidate a cession or assignment of the right of precedency, will be better qualified to work the lease than that first candidate himself, because that cession or assignment is in itself a full acknowledgment of the superior means of the assignee. Our present patent law takes quite a different view, and looks with a very jealous eye upon the assignees of inventors; and in Parliament they are not allowed to have the right that is acknowledged to belong to inventors themselves: this is particularly observable in the House of Lords, who have a Standing Order (which is in effect a law) that no assignee of an inventor shall be allowed to bring in a Bill for an extension of the term of a patent. Hence, if an assignee has worked ever so much upon an invention that he has purchased, and brought into use for public benefit, he cannot be allowed to state his case.”

To this letter I received an answer from Mr. Dyer, dated the 29th of May, in which he says, “ My own ideas accord entirely with those expressed by you upon

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“ the subject of the proper policy of patent law, and especially with reference to
 “ the general worthlessness of first ideas of inventions (which is all that can now
 “ be secured by patent) unless those first ideas are followed up by extended experi-
 “ ments, and improvements upon the first suggestions. As the law stands now,
 “ every patentee must endeavour to avoid any alterations and improvements on his
 “ invention, however valuable in practice, lest such alterations should vitiate his
 “ right under the patent; and as to taking out a new patent for improvements,
 “ besides the objection on account of the heavy expense of such new patent,
 “ it would seldom hold good, because such improvements are made progressively,
 “ and are brought into use one after another, almost imperceptibly, in consequence
 “ of the experiments and alterations made in the course of extensive practice;
 “ hence such improvements must unavoidably become known to the people em-
 “ ployed thereon, long before a patent can be obtained for them, and that previous
 “ knowledge, it seems, would be held fatal to the new patent. Also, the existence
 “ of a first patent is often deemed sufficient to void a new patent for improve-
 “ ments, although by the same inventor, because the first, being for a crude in-
 “ vention, not useful in practice, when executed as described in the specification, that
 “ patent fails; and then the second patent fails on account of the invention being
 “ published by the first. I am sorry that my want of health absolutely forbids my
 “ going up to attend the Committee.”

Have the goodness to state who Mr. Dyer is?—Mr. Dyer is an American, and the origin of his settling in this country is worthy of notice. A self-acting machine was invented here thirty years ago, for making wire cards for preparing wool and cotton; it bended and cut the wires, pricked holes in the leather, and inserted the bended teeth into those holes, by one operation, without manual labour; a patent was taken for the invention here, by Messrs. Sharp and Whittemore, in 1799. The machine was very ingenious, and was made to operate with rapidity; but the cards produced by it, were too coarse and imperfect to be used with advantage in this country, where the art of card-making by hand had previously been brought to great perfection; the inventor therefore carried his machine to America, where coarse cards were more in requisition; and as our laws prohibited the exportation of any of our cards, the want of efficient card makers in America rendered a self-acting machine of value there, although not very perfect in its operation; he succeeded in America so far as to carry on a trade, and by practice improved his machinery, till it supplied the American demand very well. Mr. Dyer, who was at that time a merchant, became acquainted with the invention, and thinking it had attained a state of perfection sufficient to be re-exported to England with advantage, he purchased the invention, and came over here to take out a patent, when the original patent was nearly expired. I prepared the specification for Mr. Dyer's patent, in conjunction with Mr. Nicholson, in 1812, and gave him all the assistance in my power towards establishing a manufactory, which he at first intended to begin in London, but ultimately began one at Manchester. When the cards manufactured by this machinery began to be sent out to the cotton and woollen mills, they were found still too coarse and imperfect for efficient use in England; and Mr. Dyer, though not originally a mechanic, set himself to study the subject, until he was able to improve the machinery, and make saleable cards by it. His first set of machines were all destroyed by fire, at an early period of his settling at Manchester, and he lost much property, but in the end that circumstance insured his success, because he made entire new machines, with many improvements that he had found out before the fire, but which could not have been applied with so much perfection by altering the original machines as in making new ones. He was obliged to take another patent for these improvements, and has had other patents since, and has established a considerable trade with advantage.

Do you believe that many useful inventions are lost to the public, from the want of security to inventors, by the present patent laws?—There are many secret inventions of value, which it is not the interest of the inventors to disclose under the present system; but they are practised in secret, to a very limited extent by one individual, so that the public derive only a very small benefit from them; and yet the secret possessors may be getting more than they could get under the present system of patent law, by practising the same invention generally and openly, and with extensive benefit to the public. This circumstance deserves the attention of the Committee. Many men of great talent are so conscious of their superiority, and have it so generally acknowledged, that they become indifferent to the small accession of reputation that they could derive from adding more inventions to their list; hence

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hence they cease to be communicative in cases where it is their interest to keep secrets; and endeavour to realize the whole profit of a very small extent of business, for so long as they can preserve their secret, rather than look to a small share in the profit made by the public on a very extensive open practice, for fourteen years under a patent. For instance, Doctor Wollaston had a mode of preparing malleable platina, which he practised in secret for a long time, and only disclosed it on his death bed, and probably very imperfectly. Mr. Watt invented and made a machine for executing sculptures, which he never disclosed; he shewed me many specimens of the performance in ivory and alabaster, in 1814, and made me a present of one carved by his machine, which proved that it must have arrived at considerable perfection; he died in 1819, and I believe never disclosed that invention any further than as the machine may have explained itself.

I did business formerly for a very ingenious mechanic at Sheffield, named Gilpin, who destroyed himself some years ago; he had a machine for cutting the teeth of cog wheels, and another for making hard steel spindles for cotton spinning. The works he produced by them were most excellent; but he kept the means secret, and I do not think they have been practised with any effect since his death. All those inventions ran great risk of being quite forgotten, and their perfection has really been lost, by the death of the inventors before making complete disclosures; also the practice of them was always very much limited by the secrecy observed. I am not certain that a patent law, without any of the objections that I make to the present ones, would have induced the disclosure of such inventions, and certainly would not of others, which are of such a description that it is easy to practise them, and yet preserve secrecy effectually; they are mostly chemical secrets. Mr. Faraday, of the Royal Institution, could I think, give the Committee information on such subjects, which are not in the course of my studies, and I only know them incidentally. There is a process of refining the raw sulphur or brimstone that comes from abroad, which I am told is now practised in secret at a large manufactory in London, with such success and superiority over the ordinary methods, that they have brought nearly all that trade into their own hands. There is a secret black dye for silk practised in London, by Sir Francis Desanges which was, I believe, in the possession of his father before him, and has been preserved secret for a great length of time, although it has been practised to a large extent; so that they have realised great wealth by it.

There are numbers of medical secrets which are very much boasted of, but as they are out of my line, I can form no opinion if they are really of value. I know of one medical secret, which is of great importance; and as its value has happened accidentally to come fully to my knowledge, I can speak very positively upon it. It is a peculiar medicine and a mode of treatment, by which the king's evil or scrophula, is effectually and certainly cured, so as never to break out again. My only child was so afflicted with scrophula, as to be in danger of becoming blind, and crippled in his limbs; I had the best advice, and followed it strictly, until I found that his case was quite out of the reach of any medical assistance in England; and then I took him to France, to try the skill of that school, but it proved no better, and I was quite in despair. Hearing of this secret treatment which is practised by a Mrs. Anne Knight, at Dover-house, near Arundel, in Sussex, I made very full inquiries into its efficacy, and found that she possesses a certain specific for all scrophulous cases which are not of too long standing. As I felt very averse to submitting my child to any secret treatment, I took great pains previously to satisfy myself of the results of former cases. One was a woman, who had been cured thirty-six years ago by Mrs. Knight's husband, and has never had any return or illness; she has since married, and had two children, now grown up, and quite healthy; one of them has a large family, all very healthy children. Another woman was cured permanently by Mrs. Knight about twenty-eight years ago, and has since married, and had eleven children, of whom nine are living and grown up; they are all most healthy persons. A young man, now twenty-three years of age, was perfectly cured when a child of between three and four years old, and has ever since been quite strong. A young lady, about twenty-five, daughter of a very respectable man in London, was cured thirteen years ago, and has enjoyed very good health ever since. A young man was cured about the same time as the last, and is now twenty-five, a very fine healthy person.—I visited the above individuals, and each one told me of several other cases of persons who had been patients of Mrs. Knight's at the same time with themselves, and were all to their knowledge cured permanently; and none could tell me

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of any instance of failure or relapse. Cases of cures of less standing, but equally certain and effectual, were very numerous. The marks and scars that I saw on these persons, showed that they had been severely afflicted; they all stated that they have now very strong health. My child has been under Mrs. Knight's treatment more than a year, and is now nearly cured, and a number of other patients have, to my knowledge, been cured by Mrs. Knight, during the time I have attended her with my child. This valuable secret is in the sole possession of Mrs. Knight, who is arrived at an age when she is very likely to die without making any disclosure; and without the communication of that skill and discrimination which she possesses, (and which I believe to be necessary for the successful practice,) the mere disclosure of the secret of the medicines she uses, would be only a part of the advantage that would arise from complete instructions being given to all medical practitioners, none of whom can now cure the scrophula at all. The secret has been in her family for a great number of years; but she has given it perfection, by finding out how to apply the peculiar medicines more successfully than her predecessors. Mrs. Knight has not communicated it to her children, because they have not had a medical education, and they would not be allowed to practice by the College of Surgeons. She was herself in practice long before their Act of Parliament was passed, or else she would not now be allowed by law, to do what no physician knows how to do. I would recommend most strongly to Parliament to direct an inquiry respecting this secret, that when its value is proved, as I know it can be, a purchase may be made, and all medical men instructed in it, for the public benefit.

It would be a very good measure to reserve a portion of the revenue derived from the granting of patents, to accumulate and form a fund for the purchase of valuable secret inventions, like Mrs. Knight's, which are not likely to be disclosed by the inducement of any patent law, however complete; and also to reward individuals like Mr. Woolf, whose inventions have not come into use during the terms of their patents, but have afterwards become of national importance.

Would you not, in the latter case, rather recommend an extension of the term of the patent?—Not in all cases. If the inventor has brought his invention to such perfection, that others, by merely copying what he has done, can practise it as well as himself, it would be best to throw it open. Mr. Woolf's was such a case; the engines made on his system by others, since the expiration of his patent, have performed as well as those made in the same interval by himself, and have even obtained a preference in some places; hence the public would probably have gained nothing by confining it longer in his hands; but now that he is seen to be left quite unrewarded for his long exertions, the circumstance, added to others of a similar nature, is very discouraging to men capable of making similar improvements; and I am of opinion that the public would gain, by giving him a handsome reward. In other cases, where there are not many persons capable of taking up the new subject, its progress will be greatly promoted by continuing the patent, because that compels the patentee to continue his exertions to extend the practice. That was Mr. Watt's case. If he had abandoned his engine to the public at the time his first patent would have expired, there was then no other person competent to go on with it, and give it that additional perfection which he attained during the prolongation of the term. No law could be made to distinguish between those cases in which patents should be prolonged, and when rewards should be given instead; but the same discretion that could determine the propriety of an extension, could also decide between that mode and a reward.

With respect to the invention of Dr. Wollaston, he made it profitable to himself?—He did, and it is supposed to a very considerable amount; for every one was surprized to find that he left so much money at his death.

He could not have used it exclusively during so many years as he did, and have left it to his family after his death, if he had taken out a patent for it?—Certainly not; and in all such cases where the nature of the invention permits of secrecy being effectually preserved, no inducement of patent right will bring them forth, even if the right is made ever so secure by law; because the patent would be totally evaded by infringements made in secret, and which could never be proved in law.

Independently of the risk of such secrets being lost altogether, it is a great public loss to keep them locked up; for they cannot be extensively practised in secret, and the possessors must lay a very heavy tax on the little business they do execute in secret, with their own hands; also, the processes would be more likely to get improved, if they were made publicly known; and new applications of the inventions would be made, which are not done whilst they are kept secret. Hence I think that

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that public purchases of many inventions should always be contemplated, and a fund should be provided for that purpose. There are many other inventions where a secure patent would be preferable to attempting to preserve secrecy, although a patent, under our present law, is not preferable. It is scarcely possible to practise some secrets to a profitable extent, for any length of time, without losing them in the end; for the precautions that must be taken to ensure the secrecy, must tend to cramp and limit the exercise of the invention so much, that only a small proportion of the profit can be realized, that might be made by an open use of it, under a patent, if it were secured by law and for a long term. The medical secret of Mrs. Knight is an instance of the pernicious tendency of secrecy; for although the secret has been safely kept in that family for the greater part of a century, they have taken every possible precaution, and by that care have so limited their practice, as to have only gained a very common maintenance by it; they have refused to send out medicines, for fear of analysis, but stand by to see them taken; they have employed no assistants to compound the medicines; and hence ten or a dozen patients at a time, are as many as can be treated with success. Mrs. Knight has rarely had so many as she could have managed, because the better class of persons have a great aversion to a secret mode of treatment by a woman, and will not go into the inquiries that I did, as to its merits. Mrs. Knight's family never put the secret into writing, for fear of accident, and hence it has always been subject to be lost by the sudden death of the possessor for the time. Hundreds of valuable lives have been lost by the scrophula, and most excessive misery endured, which might have been avoided, if this specific had been made generally known to all practitioners thirty years ago; and probably it might be applied to other uses in medicine.

A process that requires the co-operation of a number of persons for its performance, and the aid of machinery, would almost always be disclosed, if the patent laws were unexceptionable, because it is scarcely possible to keep it long secret. Messrs. Darwin, of Sheffield, had a means of making rollers of steel, for silversmiths' flattening mills, perfectly cylindrical, and with a most exquisite polish, when quite hard; they had an exclusive trade for some years; and also for silversmiths' hammers and anvils, of hardened steel, polished; but their secret got out, and others now compete with them in some measure.

A machine was used in secret for many years in London, to split hides and skins into two thicknesses, but it became known in time, and others were constructed; the secrecy that was observed retarded the improvement of it, and it did not perform very well until it became more known, and then it was brought to great perfection.

Mr. Lowry, the engraver, invented a machine for ruling parallel lines, for the shading tints in copper-plate engraving; and also the use of pointed diamonds for drawing on the copper; he used it in secret for years, whereby much of his own time was taken up, in secretly doing a common operation with the machine, which any careful person could have done as well as himself, thereby applying less of his time to those exquisite works of art that none but himself were capable of executing; at length his secret got out, through the workmen he employed to make and repair his apparatus, and other machines came into use; he then set young pupils to rule by his machine, and allowed them to work with diamonds.

Mr. Boulton invented and established a mint for coining money at Soho; he took a patent for it in 1790, but afterwards he found out and applied a method of working the coining presses by a steam engine, by the intervention of air pumps, applied to exhaust air from a receiver, and the effort that the atmospheric air makes to enter into and refill that exhaustion, is caused to operate upon and impel pistons fitted into cylinders, from which the air is drawn away into the exhausted receiver; those pistons are so applied as to give motion to the coining presses. This method has been kept secret to this day in England, although the coining presses worked by it are publicly shewn in the Royal Mint. Mr. Boulton fitted up a mint for the Empress Catharine in Russia, and he sent out another to Denmark, but the foreigners do not conceal the air-exhausting method of working the presses; I was allowed to take drawings of the machinery when I was abroad. It is a very valuable invention, which is capable of many other applications. Mr. Hague has recently taken a patent for working tilt hammers by it; also cranes for unloading goods; and that method also suggested to him the patent machinery that he has made for extracting the molasses from sugar, which I mentioned to the Committee before.

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Many years ago Mr. Watt invented and applied a small instrument which he called an Indicator, to his steam engine; it indicates what extent of plenum and vacuum is alternately formed within the cylinder, in order to impel the piston when the engine is at work. It is of very important use in giving engine-makers true knowledge how to make good engines; and it was of very great use to the inventor, just as a hydrometer is to a distiller. He kept it a profound secret for many years, and in 1814, when he published an account of his other inventions, he gave only an imperfect description of a part of this one, without any hint of parts which are essential to the successful use. A complete instrument afterwards fell into my hands in Russia, where it had been made by some of the people sent out from this country, with Mr. Watt's steam engines. At my return to England I made one, and also shewed several other engineers how to make such for themselves; and since that time every one of those persons has very greatly improved his practice by the light it has enabled him to throw upon an obscure part of the operation of steam in an engine. One person who had made an indicator from a sketch that I drew for him, has since printed a description of it in a public journal.

Did Mr. Watt use his invention of a machine for making sculptures, as a matter of profit?—No; but it was obvious to me that he had attained considerable perfection in small works, and soft materials; It might be supposed that his motive for keeping it secret was that he intended to take a patent when he had perfected it, but I have heard him declare, that he had suffered so much anxiety and trouble by the law suits on his patent for the steam engine, that nothing would induce him ever to take another patent; he never made any profit by the machine for sculpture.

Do you conceive that he had brought it to perfection, or that he was only making experiments?—I know he had obtained a certain degree of perfection, for it carved good work in ivory and alabaster, and he was striving at more to make it carve marble, and hard materials; he shewed me some first trials in stone, but they were not perfect, and he did not live to complete a large machine adequate for executing real sculptures in marble. Mr. Chantry executed Mr. Watt's bust, whilst he was engaged in this invention, and could probably give some information concerning it.

Do any evils arise in factories from the workmen being entrusted with secrets which it is in their power to divulge to the injury of their masters?—Yes, the evils are excessive, in the insubordination that they induce; for such workmen cannot be kept in any control, because emissaries from rival manufacturers are always on the watch to seduce them, and they have at all times the means (even if they are under bond to continue to work for the masters) of communicating the secret to rival manufacturers, and thus spite their masters, as well as get bribes for themselves. They may safely reveal the secret at second hand, and there is no remedy whatever, because the communication from them to an intermediate agent, and then from that agent to the rival manufacturer, admits of no proof.

Are workmen occasionally under bond?—In many factories where new processes are practised, workmen are under bond to work for a master, under fixed conditions, during a certain term; they are considered as grown apprentices. It was more the custom formerly than it is now; because it is not found to answer. I am informed, that if the master reserves the power of annulling the bond, it is not legal; and it is a hazardous measure for a master to engage a large number of men, at an absolute certainty; for when trade falls off, he might be ruined, if he could not discharge his men. To come under the nature of articles of apprenticeship, I believe, the bond must be reciprocal on the man to work, and on the master to teach and employ for the term.

Is the keeping the secret a part of the obligation of the bond?—Yes, in many cases it used to be; but as it has never been well decided whether a condition of that kind can be enforced in law, there is a doubt about it. In France it is a positive law in the code, and is constantly acted upon.

Is it not attempted to retain secrets by making the persons entrusted with them, enter into a bond subject to penalties?—It has been attempted, but I believe it has not succeeded; and I know is not commonly done now. The bonds I have known, are merely that the workman shall continue to work for the master during a certain term, under the specified conditions of hours of labour, and wages; but it is of very little avail, for if the workman does not like his place, he will remain under the bond in the factory, and do all the mischief he can, without subjecting himself to the law. I have known magistrates commit workmen for going away, when under such bonds; but I have no doubt, if application had been made to the Court of King's Bench, it would have been found illegal.

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Where a bond has been given not to divulge a secret, have you ever known the penalty recovered?—Not from any workman. In the case of *Smith v. Dickenson*, in 1803, (respecting which, I added a note to my former evidence) damages were given.

Do you believe, according to the present state of the law, such a penalty could be recovered?—It is generally understood among such manufacturers, that penalties could not be recovered from workmen, and hence they do not now insert any in the bond; whilst the workmen thought it would have any effect, it was well to put it in; but now the workmen do not care for it.

Is that system very common?—No; it is only in new trades where there are secrets. I have been engaged in works where some hundreds of workmen were working under bond, with very low wages in the bond; but they were allowed to get good wages by piece-work, if they behaved well, if not, the threat of reducing them to bond wages was all the power it gave; it was in the patent net lace manufactory some years ago; I found the men were never restrained by the bonds, unless it suited them, and then they would have done without; their average wages rose and fell by the piece-work, according to the state of the market, like any other trade. They had been only common laborers, and were glad to get into any manufactory, but competent workmen would not have entered into a bond for low wages.

Are you aware that patents have sometimes been supported at law, by collusion between the parties?—Yes, I have known an instance; and there may have been others. It was a case of infringement, in which the patentee feeling afraid his patent would be set aside, compromised before the trial, and arranged that the trial should go on, but that the infringers should defend themselves so as to secure a verdict to the patentee, and make it appear to the public that the patent was good at law.

The effect of that verdict would be to give the public an idea of the validity of the patent having been tried, when in fact it never had been fairly tried?—Yes, it would; and the conditions of the compromise were, that the infringers should take licenses at a very high premium, only part of which was paid; and that all parties should make a common purse, to prosecute and prevent any others using the patent; the patentee granting no more licenses. The patent was thus converted into a close monopoly. It would not have been the interest of the patentee to have submitted to this, if he could have enforced his patent in spite of any one. For if he had been sure of maintaining his patent, it would have been more to his interest to have granted as many licenses as he could, and thus made the practice of his invention very general; but under the uncertainty, it was better to secure a portion of his patent right by collusion, than to run the risk of losing it altogether by the uncertainty of the law.

Do you think, that in a majority of cases, it is the endeavour of the patentee to word his specification so as to deceive the public, and keep back the real method of practising his invention?—Certainly that is not the fact, in a majority of cases. In my own practice, which is of more than twenty years standing, and has been tolerably extensive, I am certain there has not been one case in a hundred, where the patentee has shewn the least disposition to conceal any thing, or control me as to what I should put into the specification. In general, in addition to the most ample communications from themselves, they desire me to go, and send my assistants, to inspect, and make drawings, and trials of their apparatus or machinery, giving orders to their servants for our admission at all times, in their absence, and to answer all our questions; by which means I have sometimes acquired a knowledge of particular properties and results of the invention, sooner than the inventor himself. I have found that a decided majority of patentees desire me to specify in such a style of language, and with such drawings, as they think will do them most honour in their character of inventors.

Patentees would be very stupid to attempt concealment, for such attempts must prove abortive, and would defeat the very object they have in taking a patent, for it would certainly be detected by the first infringer who set about practising the invention, and according to the present law, any concealment would vitiate the patent right; but that I think impolitic and often very unjust, because unintentional omissions or obscurities cannot be distinguished from wilful concealments. The examination of the specification which I recommend to be made, before it is received for enrolment, ought to detect and prevent any attempt to conceal, and would ensure disclosure, if the examiners were competent persons. If they were not, or were careless, and allowed an obscure specification to pass, there would always be a complete remedy

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by giving the courts of law (or other tribunal appointed to try patent rights) a power to inquire into the sufficiency of the specification, just as they do now; with only this difference, that if they found it defective in description, they should order the patentee to bring an amended specification; but should not set the patent aside for such insufficiency, unless the patentee refused to make a new specification to the satisfaction of more competent examiners newly appointed for that purpose, but still subject to future inquiry into that sufficiency.

I have been told that patentees for new medicines commonly enrol fictitious specifications, and keep back the secret of the compositions; but I do not know the fact. Dr. James is said to have done so with his fever powder; if that is true, such patents can be of no use but to adorn advertisements with the King's arms. If there have been many patentees, who have intended concealment, they have not come to me, and I am certain they can have been only a small proportion of those who have taken patents in the time that I have been in business.

An examination of the specifications that are on record will, I am sure, prove to the satisfaction of any person competent to judge of different styles of composition, that the bulk of those in which there is obscurity, have been written by illiterate persons, unaccustomed to communicate their ideas. The most suspicious class are those specifications in which the real meaning is buried in a jargon of law phrases, which is better adapted to raise quibbles in a court of law, than to instruct artists in their workshops. It is obvious that such cannot be written by the illiterate inventors themselves; but the attempts to entangle infringers by legal subtleties and intricacies, does not answer, because the patentees find to their cost, that such puzzling specifications will not support the patents in court; they are continually set aside. The Judges usually make inquiries of practical men, and if those men get bewildered in law phrases, that is conclusive against the specification, and it is in vain for ingenious counsel to argue, that the words are explicable in law, the court will go by fact, that it is not written properly for artists.

Do you conceive the protection by a patent right is calculated to render new inventions more generally known and used?—Decidedly so; and particularly to give them every chance of attaining that perfection without which they cannot be brought into profitable use. It is not often that any individual has so much want of a new invention or improvement for his own use that it is worth his giving the requisite skill, time and money to bring it to bear, even if he has the means; and if he could not get some premium for allowing others to use it when perfected, or else keep it to himself to protect himself from competition, he would commonly remain a loser. Very large manufacturing establishments have a great advantage in that respect, because it costs them less to bring inventions to bear, and the profit from their own subsequent use is greater; and hence they do not care much about patents for small improvements; but such a protection or at least the expectation of it, is essential to the establishment of great inventions in use.

Do you believe that many useful inventions would never have been prosecuted to the public advantage if they had not originally been worked under a monopoly?—By a monopoly I understand a confinement of trade in the hands of an individual; but if licenses are granted under a patent, I think there is very little harm can be done by any patent right, for it makes no restriction, but only levies a small tax on a new and profitable business, which can certainly bear that tax, or else it could not be levied. I am of opinion that many great inventions would never have been brought to bear as they have been, but for the encouragement offered by a patent. Mr. Watt's steam engine may be quoted as a great example: at the time Mr. Watt made his invention in his own mind in 1765 he was not a maker of steam engines, and none of the makers at that day had sagacity enough to see the value of his discovery before he had made an engine, nor would any of them have prosecuted his plan before it was proved, even if he had made them a present of the invention, much more to give him any thing for it; hence he had no means of making any profit from his invention, or any prospect of repayment for the great expense and labour necessary to bring it to bear in practice, unless he could have secured it to himself for a long term. Mr. Watt at the time he took out his patent in 1769, was a man of known talent, rising into business as a civil engineer; I have letters from him to Mr. Smeaton, and the answers, in which I find Mr. Smeaton considered him as acting most imprudently in quitting his proper professional pursuits to follow up this new invention, of which Mr. Smeaton had nevertheless a very good opinion as a philosophical discovery, but he considered that the difficulties of executing it with such perfection as to be fit for common use, would prove so insuperable that Mr. Watt would

would only ruin himself in the attempt. Under these circumstances it is certain that if Mr. Watt could not have obtained a patent, he would have done nothing further than make a plan, and at most publish his invention as a philosophical discovery, to do himself honour; in that state his engine might have remained till this day without any one useful application of it being made; for no man to this day, has made so much profit by the use of Mr. Watt's steam engine for his own work in any trade, as would have paid the costs of making a first engine and getting it to answer for his own use in real business, supposing that Mr. Watt had published a complete plan for it; because the difficulties of a first execution are so great, and require talent and labour, as well as money, to overcome them. As it was, the hope of securing the invention to himself by patent, induced Mr. Watt to devote his whole time and his whole attention to bring his invention into use, and according to a phrase used in one of his letters "he staked his all upon it." The words are "I have been tormented with exceedingly bad health, resulting from the operation of an anxious mind, the natural consequence of staking every thing upon the cast of a die; for in that light I look upon every project that has not received the sanction of repeated success." This was in April 1776, which was eleven years after he had made the discovery of his principle, and seven years after he had obtained his patent, and during all which time he had devoted himself entirely to the execution; it is not to be supposed, that any one would have gone through all this toil, without being assured of a property in what cost such a man so much to acquire.

The history of Mr. Woolf's invention is very similar, with the difference that Mr. Watt having, through Mr. Boulton, obtained an extension by Act of Parliament, he acquired a large fortune during the prolongation. Whereas Mr. Woolf's patent expired before the actual outlay had been repaid; so that he is left a real loser by his invention. The previous inventors of steam engines, Mr. Savery in 1698, and Mr. Newcomen in 1710, were similar cases; they lost money. I have published a very full history of the origin and progress of the invention of the steam engine, which shows these facts in a striking light; but it is not peculiar to the steam engine, for all important inventions absolutely require the inducement of patent privileges, and which ought to be for longer terms than fourteen years. The paper-making machinery is another instance; an act of extension was made, but the patent was afterwards set aside at law. The process of smelting iron ore with pit coal, instead of wood fuel, which has proved so important to this nation, is a strong case; the original patentee, Lord Dudley, is mentioned in the Statute of Monopolies, 21 James the First, 1628, but he ruined himself by his attempts to bring that invention to bear; and it was not till more than a century afterwards, that it was successfully practised.

Is it your opinion that many inventions are more quickly brought into general use, in consequence of a patent having been obtained for them, than they would have been if they had been left to themselves without a patent?—In almost all cases it is so, but in some few cases it is not; those are cases where a patent is taken by a manufacturer, to keep an improvement in his own hands, and prevent any others practising it, in competition with him. In all cases, an invention is more speedily brought to perfection under a patent than without, and in most cases it is more speedily brought into general use.

Will you explain the mode in which you conceive a patent operates in giving publicity to, and accelerating the introduction of an invention into general use?—It operates by inducing the manufacturer under a patent to set up workshops, with tools and means to make the new-invented articles in a large way, and with division of labour, consequently they are made better; also to send out travellers, and to advertise, whereby the new-invented articles are pushed into general use, as far as their merits will admit, which would never happen from the languid and indifferent proceedings of individual workmen, who are engaged in some other trade, but who might now and then try to make the new articles one by one, without setting up proper tools or system, and who would consequently make bad articles, which, being sent out, would tend to bring the invention into disrepute, and thus spoil the market as fast as it was opened. I consider, in general, that the public derive some benefit from many patents for trivial inventions, such as snuffers, stirrups, lamps, cork-screws, and many other articles of domestic use, which can be of no material value to the public, for the use and exercise of the inventions; but by the operation of patents, the making and vending of patent articles (which have merit enough to sell) is multiplied and accumulated into considerable trades, which would never have arisen to any such extent without patents; because no indi-

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duals would have devoted themselves to have created such trades, if others could have supplied the demand as freely as themselves when created; but having been cultivated under a patent, and established as distinct trades by interested patentees, such trades continue to be permanent after the expiration of the patents. That is the origin of a number of considerable trades at Birmingham and Sheffield, and in London. They have arisen from the demand created by many trivial articles or inventions, which if they had been manufactured when new, by every individual who might have thought it worth while to try to make a few, would never have been advertised and pushed into use, so as to create an extensive and distant demand; because the new articles first sent out by individual workmen, would be badly made, so as to fail in answering the purpose of the consumer, and the extension of the demand would thus be prevented; whereas a man, manufacturing under the protection of a patent, sets up at first in a large way, with the aid of tools, and establishes a system of subdivision of labour amongst his workmen, and makes a study of every part of the business; he advertises, and sends out travellers with the new articles, pays attention to rectify all complaints, and satisfy all the wishes of consumers, and by inducing shop-keepers and merchants, to sell, and to export, establishes a trade. In short, by using every means which an extensive business in one article admits of, and which a divided business in a variety of articles does not admit of, he creates a new trade in making and vending articles, which are too trifling to be of any importance in other points of view.

Every patent is granted for the triple purpose of making, using and vending, the new invention. In what I designate as important inventions, the using of the invention is the greatest item of its value to the public, the making may be another item, but of less importance, whilst the vending by shopkeepers may be scarcely worth notice; that is the case in steam engines, spinning machinery, gas lights, weaving, ropemaking, &c. But in others which I have called trivial inventions, although the use of them is not worth consideration as a public benefit, (being only for individual convenience) yet the trade of making and vending of the new articles may nevertheless, by the operation of a patent, be rendered an object worthy of some encouragement.

For all these reasons I am opinion, that the operation of some system of patent laws is indispensable to the protection of inventors, and to induce the efficient cultivation of important inventions; it is also favourable to the erection of trades upon trifling inventions. On the other hand, I do not know any instance in which a good patent law could be pernicious, because every patent that is really defective in invention, would work its own cure. Even under our present system, which I think a bad one, all those cases of patents for absurd inventions, which degrade the patent lists, are abortions, which have no operation whatever, except to bring patents in general into contempt. But all that is no great harm, unless we except the abuse of establishing a substantially good, but legally bad, patent right, into a monopoly by collusion.

What do you mean by a bad patent right?—Where a powerful infringer, by discovering some technical objection or flaw in the deeds, finds it in his power to set a meritorious patent aside; and by threatening to do so, and to go to any expense for that object, he obliges the patentee to make a compromise with him, to refuse any more licenses, and repress all others who are not aware of the defect; for if the patent appears substantially good, they who are not in the secret, will be afraid of the result of an action, and still more of the expenses of the law; hence the patent can be kept up as a monopoly by terror, for the patentee is frightened into the measures of the powerful infringer, by the threat of exposing the technical defect of his right, and those measures are to frighten all others out of the new trade, by representing the patent to be good in law.

Do not you consider those small patents as capable of being protected by that sort of collusion as any others?—Yes, much more so than important ones, because individuals have less inducement to incur the expense of contesting the patents at law. Manufacturers capable of carrying on a great invention or trade, are not so easily deceived, nor would they be deterred by the expenses of law, but would certainly bring the patent right to trial, even if they did not see any technical flaw, because it is so generally known that patents are always likely to be overturned, that it would be worth the costs of an action, to have that chance of getting over a patent for a great invention, though not for a small one.

Is not that an argument against the multiplication of patents for trifling inventions?—Yes; the evil of multiplying legal rights is always great.

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Especially where they can be supported by fraud rather than by fair law?—Yes; that is the reason why I do not recommend patents to be granted cheaper, unless some other check, than the cost, were applied to limit the number of them; and if it were not for the difficulty of distinguishing the merit of inventions beforehand, I should recommend a previous inquiry and selection, and the terms to be made shorter for trifling patents, and longer for more important ones, but I fear such a system would be abused. It should be observed that the collusion above described, is founded solely on the obscurity of the present law, and its technical difficulties, conjoined with the expensive nature of law proceedings on patent rights, and would not happen under a good system.

Persons take out patents occasionally, not for the purpose of using the invention themselves, but of licensing others; did you ever know where licenses under a patent were publicly in the market, that a patentee refused to license a particular individual?—In practice I have known it refused at first, but afterwards granted; for a party so refused can always practise the invention without a license, and the patentee would, I believe, get only nominal damages awarded by any jury from an infringer under such circumstances of unfair partiality in granting licenses. Patents are often taken out by rival manufacturers, where there is enmity and ill will existing between them; and sometimes the great motive of taking a patent is to steal a march upon some individual rival; but it cannot have much effect to refuse licenses to such rival, for I believe that in most such cases, if a license were refused to a party tendering such a fair price for the same, as had been accepted from others, there would be but little chance of a jury awarding real damages against such party for infringement. Even if the patent were ever so good, they would, I think, give only nominal damages in a case of manifest ill-will. The costs attendant upon such verdict with nominal damages would be sufficient to suppress future infringements, if the invention were a trivial one, but not if it is an important one.

Have you known any case in which a license under an established patent having been refused, the parties have proceeded to work?—Yes, I have known some; but I know of no instance, in which an action has been brought into court for such an infringement; for even if the patent has been established by a previous verdict, so as to leave no great chance of overturning it, the counsel for the patentee would advise him, that it was very imprudent to proceed to a trial which might set the patent aside, if it went wrong; but which was not likely to procure damages in the event of success. And in cases of a first trial, where the validity of a patent has not been established by a previous verdict, damages are not usually given, and are rarely asked for; as it is considered to be only a trial of the question of right under the patent.

Is not a license often refused from a motive of ill will between manufacturers?—It is so well known that the refusal would be inefficacious, that licenses are not often refused now; it might be in former times; when ill will exists, licenses are very rarely asked for, so that a patentee scarcely ever gets an opportunity of refusing them. In general patentees are very eager to grant licenses to any one who applies for them at any sort of fair price; because such taking of licenses is an acknowledgment of their right, does credit to their patent, and induces others to apply for licenses, all those motives would be strengthened if the applicant were a declared enemy.

Is it common for a patentee to license a certain number of the trade, refusing to license more?—That is seldom done, unless his patent becomes doubtful or difficult to maintain; then it is sometimes done.

In the case of the lace trade, was not there an agreement made that only a certain number of persons should be licensed?—In that case no licenses were granted originally; but all the practice beyond that by the patentees, was begun in infringement; and when those infringers had gone to a great length, and a large number of actions had been entered against them, and one was appointed for trial, a compromise was made, that they should all be licensed, and pay rent, for just so many machines as each had then really at work. The patentees also engaged not to grant any new licenses, nor to work more than a certain extent of machinery in their own manufactures; and to prosecute all new infringers, in the most expensive manner. In that case the patentees had an interest to make that agreement and compromise with the infringers; but if they had disliked such a measure ever so much, they must have come into it, in order to avoid the risk of overturning the patent; for two defects were discovered in the specification, which, though very little known, rendered it doubtful, though not certain, whether it could be supported, if those defects had been pleaded.

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The property in that patent was divided, and some of the proprietors were much more interested in restricting the use of the patent to their own manufactories (and as few others as they could) than in licensing under the patent right; another had a larger interest in the patent right, than in any manufactory, and the premium or rent of the licenses (which then amounted to 12,000 *l.* a year) might have been extended so as to become more important to him, than keeping out others from the manufacture; he had therefore an interest to grant further licenses, but that interest was quite over-ruled by the circumstance, that if they had granted any further licenses, the whole body of infringers would not have paid any more rent, but would have continued, or renewed, their opposition to the patent, and would have allowed themselves to be brought to trial, one after another, at their common expense, which it was feared would not have failed in the end to have upset the patent.

As the doubtful point in the patent right was not at all known beyond the circle of the combination between the patentees and infringers, there was very little risk of any new infringers doing harm. The substantial merits of the patent were unquestionable, and were proved by proceedings in a trial on another subsequent patent for improvements, which patent was set aside on the ground that it was not a new invention, for that the first patentee was the real inventor, whereby he got that part of his case proved without bringing his own patent into court. The great fault in the specification which was the weak part of his case, was a clerical omission that no persons could find out, unless they went through the making of a machine exactly by the specification. All the early infringers had done so, and had thus found out, how to make their peace with the patentee, but of course they kept the secret, and the later ones did not find it out, because they began to infringe, by making improved editions of the machine, and not those described in the specification.

Any persons determined to use that patent invention might, according to your former statement, have used it with impunity as there had been a determination of the patentees to withhold licenses from them?—Not with impunity, because of the expenses of a verdict against them with costs; it never came to the test, but it was always my opinion that a jury would not have given real damages against any infringer who was excluded from the trade which others were permitted to practice under license. But independently of that doubt, the costs that they would have had to pay, under a verdict with only nominal damages, was enough to deter all those who had any desire to work the patent (after the formation of the combination and limitations under licenses) from attempting to infringe the patent, when it was so supported by combination and money. It should be stated that the machines that were licensed at first, were so numerous, and they admitted of being so much improved in their productiveness without departing from the regulations of the combination, that they were made to supply the gradual increase of the market without any great call for new ones; hence those engaged in the combination were satisfied, and remained firm to it, and there was no such very great inducement for new beginners to enter into the trade, as to be worth the expense of a contest at law; and independently of expense, they would not have had much chance of overturning the patent for want of evidence against it, because all those persons were in the combination to support the patent right, who could have given evidence against it, on the omission in the specification, and on the pretext that some part of the invention as specified was not new, although it was acknowledged that the machine itself was quite new.

Was not an attempt made among the manufacturers to limit the number who should use that invention, after the expiration of the patent?—I believe there was such an attempt made, at the expiration of the first patent; the combined manufacturers were to continue to pay a reduced tax to the patentee, who was to keep up the exclusion by the threat of prosecuting new intruders under a second patent for improvements of the original machine; if that measure had succeeded it would have kept up the monopoly for four years longer; but there was such an obvious certainty that the second patent could not, by any contrivance, be brought to bear against the new beginners, that they only laughed at the threat of prosecution under it, and the attempt failed; as did also another subsequent attempt to set up a still more recent patent for improvements, which had been adopted by a part of the trade, but in such a very different mode from what was specified, that the patent could not by any construction be brought to bear against them.

Did you ever know such combinations and collusions to occur in respect to any other patent right?—I have been told that Mr. Arkwright's patents for cotton spinning were managed much in the same way, but it was long before my time; his second patent, dated 1775, was set aside for insufficiency of specification in 1785;

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I am not aware of the fact, whether he did employ collusion to support his patent previously or not; of course such things are generally kept secret from those not actually engaged in the business. There cannot have been many instances of supporting invalid patents by getting up sham trials between the patentee and his infringers, after a compromise; because the Judges are so acute in observing technical defects in a patent and specification, that they find them out, even when they are not pleaded by counsel; I believe that verdicts can scarcely ever have been obtained by collusion, unless the defects of the patent have been such as would require evidence to support them, and that the parties could by collusion withhold that evidence.

Would you think it desirable that patentees who grant any licenses, should be compellable to grant to the public without distinction?—That compulsion would be so difficult to apply equitably, by any plan that I have thought of, that I am inclined to the opinion that any such compulsion would be abused, and ought not to be enacted. I think it ought to be rendered as much as possible the interest of every inventor, to encourage the unlimited use of his patent, and to lead him to prefer a small tax on an extensive trade, rather than a heavy tax on an exclusive trade, or a trade rendered unusually profitable by exclusion. The present insecurity of patent rights, and the great expense of proceedings, has a strong contrary tendency; because the more persons a patentee licenses, (unless he gratifies them by making them a monopoly,) the greater number of opponents he provides against himself, to set to work to discover flaws in his patent; and if a large number make a common subscription fund, for expenses, he can scarcely subdue them at law. Whereas, if fewer licenses are granted, and the trade is made exclusive, they will readily pay him a high tax, and will assist him to keep up the patent, when it is used to make a monopoly, though they would do every thing they could to overturn it, if it were only used to gather a fair and moderate tax for the inventor.

How could you ascertain what would be a fair price for license under a patent?—That might be settled by an arbitration for each individual case, but not for a whole trade, or for a long term. The difficulty is, that such fair price must vary continually with the circumstances of trade, the situation of the parties, the number of licenses which are actually in exercise at the time, in competition for the supply of the market, the demand in that market, the effect of other inventions or means which spring up after a license may have been granted, to divide the supply; in short, although the principle of arbitration would settle all these points, the expenses of doing so, as often as would be required, would I think be a worse evil than the present law proceedings. It would be like attempting to provide means by law for fixing a fair rent for leasehold houses, or fixing a fair price for wages. All such laws and regulations are premiums for chicanery; knavish jobbers will study, and find out how to evade, or use them to their own purposes; but honest traders who have other occupations, cannot contend with such men, when armed with coercive laws, and are always losers by regulations which require any thing of discretion, or attention to circumstances, in their application. It is desirable for the public good, that the extension of the practice of new inventions should be made as great as can be; but a power in the patentee to limit the exercise of the invention, is sometimes of use, to protect those who have recently embarked in the new invention, from undue competition, arising from excitement and delusion, which could not last long; his own interest, if he understands it correctly, will commonly lead him right; for it is rarely that the interest of a patentee, if he has a firm patent right, will be different from that of the public in the long run. If he has a patent that is insecure at law, it is his interest to resort to trick and fraud, collusion, combination or monopoly, to keep up his patent if he can. But after all, a patent right, which stands on its own merits, can never do the public any positive injury. The case of monopoly, such as the lace trade, (or Arkwright's,) could not have been maintained as it was, if the persons who were admitted into the monopoly had not formed a very large majority of all those who had any desire or interest to practise the invention; for if the patent right had been attacked by a stronger body of new infringers, they would have overturned it, if invalid, or if it had on trial proved valid, then the patentee would have found out his own power, and that he might command his own terms, and would no longer have submitted to the combination which restrained him as well as others. Hence I conceive, that the existence of such a monopoly depends upon the circumstance, that the patent is sufficiently exercised, to very nearly supply the existing demand for its productions. The patent might certainly do more good, if fairly worked than if abused; but it must, in my opinion, always do some good, or it

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will work its own cure, either by the patent being set aside, or by the patentee becoming sensible that it is worked to less than its maximum of profit to himself.

So long as the public retain free liberty to use all the means that they possessed before the patent, of doing the same thing as is to be done by the patent invention, it is not conceivable to me, how they can be losers by the patent for that invention, under any circumstances whatever. If the patentee were absurd enough to lock up his patent invention altogether, the public would lose nothing that they ever possessed. Or if he over-works it, so as to ruin himself, still the public cannot be losers.

If a man is a great manufacturer himself, in the business to which his invention relates, his interest in his own manufactory may be greater than that in granting licenses under his patent to others; but it is evident that such cannot be the case unless he has the means of supplying the public demand for the new article very freely; hence they cannot lose much by the monopoly he establishes. If he permits no competition, he may keep up a high price, but if he carries that too far, he will check his own trade; for he must meet the competition of all those who practise the business in the old way, and he cannot by any means get more than a fair share of what the merit of the new invention entitles him to; the only evil is limiting the practice.

Mr. J. C. Daniell invented a new process to improve the lustre of woollen cloth, by immersing it in hot water, after the pile is set very smooth. The operation was reported to cost not more than a penny a yard; but that it increased the value of different cloths, to the amount of from two to five shillings per yard. That is to say, the same cloth would sell for so much more in the foreign, or any other market, by a penny per yard being expended upon it, in performing the new process. He is a large manufacturer, and took a patent for the invention. That patent produced a very great revenue to the patentee, whilst his patent lasted; he received I think at one time a tax of 2*d.* a yard for license under the patent; that tax was nothing, worth notice, to those who paid it, when they improved their cloths so much; but it was a greater object to the inventor than the profit that he could derive, by improving all the cloth he could possibly make in his own manufactory, and he had no interest to endeavour to make his patent a monopoly; he still retained that profit, with only a gradual diminution of it, as the practice extended over the whole trade, under the licenses he granted, but as he derived a profit of two-pence per yard, (and might have had more if he had insisted on it) upon all the cloth made by others, he had the strongest interest to promote the practice to the very utmost. If he had made a monopoly, and confined the improvement to his own trade, he could not have improved the price of his own cloth more than from two to five shillings a yard, for then he came in competition with the cloth manufactured with better wool, in the old way, without his process. Now if he had attempted by exclusion to have kept that improvement of from two to five shillings a yard, undiminished by competition, during all the term of his patent, and had even doubled and trebled the extent of his manufactory, (which however could not have been done all at once, and would have required a large capital,) still he could not have gained anything like so much as by receiving two-pence a yard on all that he could get other people to make under license; in addition to the whole profit of the improved price of all the cloth that he could make himself; taking his chance for the effect that a competition limited only by that tax could have, to reduce that improved price.

This case of Mr. Daniell's licenses may be taken as an example, to consider what would be the result of compelling patentees to grant licenses, at a price fixed by arbitration. In fairness arbitrators must in his case have awarded at least eighteen pence or two shillings per yard; when the patentee from a consideration of his own interest took two-pence. I am of opinion, from all the experience I have had, that such arbitrations must inevitably fix the price of licenses at an average of at least four times greater, than the patentees usually fix for themselves; because if they insisted upon any such prices, it would be refused as an odious tax, which would so limit the adoption of their inventions, as to diminish the total profits of their patents. I am confident it is best to leave patentees full liberty to use their rights as they think best, and the few cases of individual exclusion that might be attempted from ill-will, would be checked by juries giving only nominal damages for infringements. Mr. Daniell's patent was set aside in 1826, under a writ of *scire facias*. A man was brought to prove he had once practised the improvement many years ago, but he did not pretend to have continued the practice, or that it was ever brought into any

any use. The evidence had a very suspicious air, and if true, did not in any degree prove that the invention was known or in use, to the benefit of the public; but yet it was sufficient to set the patent aside.

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Are there not two objects in taking patents, one in which a man intends to keep his invention for his own use, the other in which he offers to others to use under license?—The greater part of them sustain jointly both characters, and I think it is most desirable that every patentee should be interested in the practice of his invention for some trade of his own, as well as in licensing under the patent; because it gives him greater means of attaining perfection in the practice of the invention, and also accelerates its introduction into use. Mr. Hall, of Basford, invented a process of singeing lace net, by drawing it over a flame of gas lights, and thus burning away all the superfluous fibres. I prepared a specification for his patent in 1819; he was not a lace manufacturer or dealer at that time, and he only proposed, at first, to dress the lace made by others; that was during the time that the trade was carried on under the limitation before stated. He asked a higher price for dressing lace, than the combined manufacturers chose to give him, and being united in a body they would not have adopted the new invention at all, if the patentee had not set up a warehouse in London for the sale of his improved lace, which he bought in the raw state, and refined it by his process. The superiority was thus rendered so apparent that a great public demand for the improved lace was created; whereby the lace manufacturers, after much scrutiny of the patent, were compelled to send their goods to the patentee, who, as his trade increased, granted licenses to others to dress lace. Many infringements on his patent were begun, but his specification and patent proved good at law, so that he established, and preserved his right.

Ought not the public, in case of the right being sold, to be enabled to come in generally?—It is very desirable that they should; and in a majority of cases, it will be the interest of the patentee, if he has the power in his own hands, to get his invention into very general use; but it frequently happens, that in a trade where there are individuals of large property, to whom the expense of law proceedings is not of great consequence, they will endeavour to combine together, in order to induce the patentee by the offer of an addition to his tax for their licenses, (or to compel him by threatening to dispute his patent right,) to limit the exercise of the patent to themselves, and debar poor men from any participation in it. I have explained before, if that the patent is at all doubtful, the patentee will be obliged to come into their measures, and then the combination may repress further infringements by the fear of the expenses of prosecutions, even where there is a probability that such prosecutions under the patent would fail.

Whom do you mean by rich men?—Manufacturers who have adopted the new invention unwillingly, because they foresee that if they do not, others, their competitors, will do so, and gain an advantage. They generally begin as infringers, but if the patent appears at all likely on the face of it to bear a trial, they combine together, either to oppose the patentee, or to take licenses and combine with him, according as he either persists in granting more licenses, or agrees to make a monopoly for them, whereby they become in effect joint patentees; sometimes the most powerful of such individuals pay for the licenses they take, and sometimes they do not, or only a trifle, if their means of resisting the patentee and overturning the patent are strong; the less powerful ones are always made to pay.

Having stated the evil, have you any remedy to propose?—The evil arises entirely from the great expenses of law proceedings, and the uncertainty of the result.

Would you propose that it should be compulsory on parties to grant licenses?—I am not prepared to say that, because, as I have before stated, there would be so much difficulty in fixing a suitable price, and also because I think that the interests of patentees will generally be that which is desirable for the public, and any administration of such a principle of compulsory sale would be full of difficulty. In most of the cases I have instanced, if the patent had been known to be capable of resisting all attacks at law, the patentee never would have suffered these participations in his rights, for it is always by a sacrifice of his interests, as a patentee, that the combination is formed. When a powerful infringer, who could scarcely be subdued with the present defective law, will assist the patentee, instead of opposing him, it is worth giving him a share in the patent, to bring the power he possesses to support the right, instead of to destroy it. I have before stated to the Committee, that patents for inventions relating to naval or military affairs, which may be required for the King's service, often had a clause to compel the

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patentee to supply all that might be wanted for the King, at reasonable prices; how the price was regulated I do not know; but I once knew a patentee, during the war, who complained of injustice; he told me that after he had set up a manufactory to supply Government with the patent articles, they set up a larger manufactory of their own, with his patent machines, and all his own remained idle. There was a dispute some years ago between a patentee for barrels, for the safe keeping of gunpowder on board ships, and some officers in the dock yards, for infringement of the patent; in the proceedings before the Lord Chancellor, he declared that he should make no distinction between officers acting in the King's service, and any private individuals who might have infringed; but then, I suppose, there was no such clause in that patent.

Would not licenses very often be given, though the patent is unquestionably good? —Almost invariably; the circumstances will be very peculiar when, under a patent known to be good, it will be the interest of the patentee to keep it to himself, and a few others, for their own use, rather than to have it generally practised under licenses; there are some exceptions to that, but they are not very common; they are all cases in which the new invention produces a new article of commerce, and is not merely a new process for producing an old article; the consequence of this distinction is, that those who practise the patent invention have no competitors who can bring the same goods into the market, without the patent invention; hence, if the patent can be made into a close monopoly, it will command the whole supply of that market, and can consequently be made to raise the price very greatly. Such were the circumstances under which Arkwright's spinning, and the lace trade, originated. It must not be forgotten in all such cases that the inventors of entire new branches of trade, do great service to the public, even if they do charge the very utmost price for the new goods; they cannot get more than they are worth, for no one would buy if they asked too much, and if they limit the supply, in order to make a scarcity, the public may do without the new articles as well as they did before they were invented; as I said before, the public cannot be injured in any way, though they may be more benefited one way than another; and yet I think it will be found, on consideration, that the interest of the patentee will usually be, to benefit the public as much as can be done by the new invention.

(Mr. Farey.) I was requested, on a former occasion, to illustrate my recommendation as to two kinds of successive specifications, by preparing some papers for the Committee, as a specimen of the process by which I proposed that patents should be granted. The paper I hold in my hand, is what I consider Mr. Watt ought to have communicated to the examiner in confidence, on his first application for his patent in 1768. For this paper I have adopted the words Mr. Watt afterwards used for his specification, but which in my opinion is not a specification, (not being specific.) That communication being rendered intelligible to the examiner, without his exercising any judgment on the value, merit, or practicability of the project, and being definitely worded, and divided into as many distinct articles as it admits of; and being also agreed to, and signed by the inventor, should be folded and indorsed by the examiner, with a certificate signed by him, and the folded packet should be sealed by the inventor with his own seal.

[*The Witness delivered in the same. See Appendix H.*]

That sealed packet being left in the possession of the examiner would form an accurate record of what had been communicated to him by the inventor.

A copy of the certificate that is indorsed on the packet should be given to the patentee by the examiner, as his title deeds of invention which he may assign; that copy should be on a printed sheet of instructions to the patentee, to inform him how to proceed, and what is the law on such points as he requires to know, at that stage of his application. I have put down the following articles as my first thoughts of what should be the chief points of law and regulation; but I wish it to be understood, that I present this paper only by way of illustration of the principles that I have recommended; and that I have not given the necessary time to study and consider the following articles so maturely, as to feel confident that I shall not see reason to alter and amend them at leisure.

[*Witness read the same. See Appendix I.*]

Public notice should be immediately given of the application by advertisements in the Gazette, and in such of the principal newspapers as the examiner thinks most proper,

proper, in the districts where the trade to which the invention relates is most extensively practised, such advertisements might be in this form.

[The Witness read the same. See Appendix K.]

If in consequence of such notice, any oppositions are offered, on the ground that it is not a new invention, or has been surreptitiously obtained, the examiner is to hear and decide upon them. If he requires to open the sealed packet for re-examination on such hearings, the applicant to have notice, that he or his agent may be present, and may seal it up again himself.

Within three months of the date of the deposit, the patentee must get his specification examined, completed, approved, and inrolled, so that it may be transcribed into the patent that is to be granted with that date. But if he shews good cause, why he is not then prepared to specify, the examiner, at his own discretion, may grant more time, not exceeding three months, on condition that the patentee delivers an outline of what specification he proposes to give in, as soon as he can make it; also, making his election of those particular articles of his first deposit, that he intends to go upon, and such articles, together with the outline of the specification relating to them, to be made public; he shall then be protected against publications during the extended time; and the other secret articles he may withdraw.

And on shewing good cause why such additional time should be again extended, a further extension may be made, not exceeding twelve months more. The propriety of allowing such extension, and the time of it, to be settled by award of assessors, one appointed by the examiner, the other by the applicant; these assessors choosing an umpire, and proceeding on the principle of equitable arbitration between the public, and the inventor.

By way of example, I have sketched out the records of such proceedings as would have taken place on Mr. Watt's application, if the regulations that I recommend, had been then in force; and also I have drawn up, as an example for a specification, a brief description of the first steam engine that Mr. Watt did get to work properly about 1773. These papers explain themselves.

[The Witness delivered in the same. See Appendix L. and M.]

Are you aware of the expenses which have been incurred on trials of patent rights?—I know them to be very expensive, and to amount, usually, to more than 600*l.* for each party. Mr. Daniell's costs in defending the *scire facias* by which his patent was set aside, was 750*l.* I have not preserved notes of the items of the expense of those in which I have been concerned, except of one which I before mentioned to the Committee; it was tried last January in the Court of King's Bench, on Clegg's patent for a gas apparatus; the patentee's costs amounted to 718*l.* for one trial, and the particulars, when summed up, are as follows:

	£.	s.	d.
Counsel's Fees	172	17	—
Witnesses to facts, from the Country	£. 98	14	6
D° - D° - in Town	10	4	6
Scientific Witnesses, in support of the Specification	111	2	—
Coffee-house expenses for Witnesses	17	9	6
Office Copy of the Specification	15	16	—
Examining the same	2	3	4
Expenses of collecting Evidence, including Subpœnas, journey to Leeds, Agents Charges, &c.	—	—	—
Drawings	4	4	—
Court Fees	24	14	—
Proceedings in the Action, Special Jury, Briefs, Documentary Evidence, Letters, Attendances, &c.	220	15	10
	£. 718	—	8

The patentee obtained a verdict; but the above costs were taxed, and the infringer had only 432*l.* of them to pay, leaving the successful patentee much out of pocket; for, in addition to the above costs, several models and machines were constructed, for the purpose of showing that all the machines described in the specification, would really operate as there described; and also for the instruction of counsel, and to exhibit in court. The expense, I am informed was nearly 100*l.*

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Will you explain how the necessity arose for so great an expense being incurred, in bringing up witnesses?—From the difficulty of explaining the subject to the court, in the manner that the law requires, and from the necessity of proving all the various facts which were unnecessarily called in question by the rule of law. The specification contained descriptions of several different distinct apparatus and machines to be used in concert, forming a complete gas apparatus for gas-lighting; every part of this apparatus was executed at first, and was then thought very advantageous; but the different parts of which it consisted, have gone out of use one by one, as they have been superseded by cheaper or better apparatus; the machines called the gas-meter and the governor, have been brought into very extensive use, and have proved valuable inventions, when executed in an improved form, by Mr. Crossley (who purchased the patent of Mr. Clegg, the inventor,) and who has established a considerable manufactory of gas-meters. It was for infringements on that part of the patent right, that the action was brought. The law requires the patentee to prove the novelty, the utility, and the sufficiency of the specification, for every one of the improvements described in the specification; hence it was necessary to give evidence respecting such apparatus as had been in use ten years before in different parts of the kingdom, but which has since been laid aside, and to prove their novelty, their success at the time, and the causes why they went out of use, that they were not positively deficient inventions at the time of granting the patent, though they have since been superseded by more modern improvements; hence the expenses were rendered very great, though the object when obtained was not great; viz. the trial of infringement respecting the gas-meter only. If the inquiry had been limited to that object, as it ought to have been, the expense would not have been so great. It should be remarked, that there was no needless multiplication of descriptions in that specification. I have before stated to the Committee, that during the time allowed for making the specification, in 1816, two varieties of the gas-meters were in progress, and we had only time to put one of the two to the test of actual working, before specifying, and therefore we described both, not knowing which would prove best. The experiments that were made within a short time afterwards, showed us, that one of them would have been better omitted, but that we could not foresee at the time of specifying. In every other part of the apparatus only one variety of each improvement is described; and my descriptions were all from real apparatus that I saw made or in action, except that one gas-meter, which could not be got to work in time. The gas-meters that have since been brought into use, and were the subject of the action, are not constructed like either of those described, but are simplified. One inquiry was, if they were essentially the same invention, though constructed in a different form; it was proved to the satisfaction of the court, by numerous witnesses, that they were; and also that the gas-meters described would operate; hence the jury gave a verdict; and on motion for a new trial, the court confirmed the patent.

Do you conceive that the expense of that trial would have been much less, if instead of going before a judge and jury, it had been tried by a commission composed of scientific persons?—The expense would have been much less; but I am not recommending such a tribunal. A new tribunal supposes a new law, and I think that the expense might be equally reduced, if a good law were established, and the questions tried as at present. The inquiries should be confined to the points of invention really in dispute; the sufficiency of the specification being insured by previous examination, and improved specifications admitted. Competent scientific witnesses should be appointed by the court, to examine the subject at the joint expense of both parties, and then be called by the court, instead of by the interested parties. Some limitation should be made as to the time to which evidence against the novelty of the invention may be carried back, and previous notice of all the circumstances of such evidence should be given to the opposite party.

Why do you not recommend a tribunal of scientific men?—Because I fear that they would be very much influenced by feelings that do not exist in the present courts; such men would want weight and firmness to control the counsel, who would perplex, and overwhelm them with rules of proceedings, and forms and precedents. Many men of competent knowledge of their subject, and of the greatest integrity, are not competent to act as arbitrators in disputes, from want of such firmness. Even experienced judges, though they will not yield to counsel, cannot avoid losing much time from their attempts to support a losing cause by subterfuges. Men unaccustomed to see through such attempts, and who were not determined to repress them, would be quite incompetent to preside in a tribunal; they might do very well in a jury, but that would not diminish expense. There are also

other

other difficulties; men of science would want the necessary practical knowledge of the arts which come in question during such trials, and they are very subject to be misled by their previous theoretic notions; and if practical artists and manufacturers were substituted, then established prejudices of trades, and jealousies of rival traders, would come into operation.

From my experience in the proceedings of courts, I have not been inclined, of late years, to complain of the administration of the patent law, by judges and juries, when it becomes known what that law is, and when sufficient evidence has been tendered. What I see reason to complain of is, the obscurity of the law; the difficulty of knowing what it is; the manifest injustice of many of its provisions when expounded by the judges, who often acknowledge its hardships; and the excessive expense of stating a case in the form prescribed, so as to enable the court to really decide according to the law. My own opinion of the proceedings of courts during the last ten years is, that where a sufficient expense has been incurred in instructing counsel, and in bringing intelligent witnesses, and providing models, so as to make the subject intelligible to the court, they examine very patiently, and decide so as to leave no reason to complain of judges and juries, but continual reason to complain of the law, and particularly the want of statute law; for even if a bad law were enacted, and made clearly known, it would be an improvement, as suitors would know what to do, and when to keep out of courts.

It appears in the account that you have delivered in, that the expenses of one party to a trial amounted, in one case, to 718*l.*; have you known cases which have cost considerably more?—Yes; to the amount of more than double and also to require a series of trials, or proceedings, so as to amount to thousands, before any decision was obtained. That account in Crossley's case is merely his expenses for one trial; he had previous proceedings in Chancery, and must have many more either to recover damages, or to repress infringements; that trial was only the question of right, a mere confirmation of his patent by the court of King's Bench.

Do you believe those cases had been managed with due consideration to economy?—Certainly not in all cases. I have sometimes had reason to suspect that expenses have been purposely augmented by one party, in order to deter and annoy the opposite party, for they must apportion their means of defence to those of the attack, or the means of attack to those of defence, and the taxed costs that are paid by the losing party, is always in some proportion to the real expenses incurred by the winner, whether properly incurred or not.

Does not the apprehension of such expense deter infringers from attempting to set aside patents, or defending themselves when actions are brought against them by patentees?—Certainly, unless a combination can be made, to subscribe for the expenses, and then the managers of the suit have every motive to increase the expenses; and quite as often the expense deters, or absolutely prohibits patentees from proceeding, until they make up a combination, and a monopoly under their patents, to provide a subscription fund; they are often driven to that course exceedingly against their wills, as well as against their interest.

Are patentees aware of that?—Some are, some are not; most attornies understand it very well; but, in general, where a combination and subscription fund exists, whether to support or to overturn a patent, the other side is usually an individual, and he has scarcely any chance. I never knew a case of combination and subscription on both sides.

Do you conceive patentees are sometimes induced not to defend patents, from the expenses which may be incurred?—That is very often the case, combined with the uncertainty of the result. It is more common for patentees to endure denial of justice by the expenses, than for infringers, because the balance of that uncertainty is very greatly in favour of the latter, and their facilities of combination greater. I have known an infringer begin to defend an action brought against him by a patentee, and then set about forming a subscription to pay his expenses, but as it did not amount to money enough, he gave up, without having incurred any expense, and took a license under the patent just before the trial, for which the patentee had made expensive preparations.

So that the expense which is incurred by an action on a patent operates sometimes against the public, and sometimes against the patentee?—Decidedly so, but always in favour of combinations, whether of monopolists, or of piratical infringers.

Do you conceive that the case you have mentioned, in which an expense of 700*l.* was incurred, was conducted with a due regard to economy?—I know that it was managed at as little cost as could be done; the attorney inquired very particularly about my charge in that business, and I believe about others, though the patentee

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himself did not; the expenses were higher than ordinary, from the circumstances I before stated, of the number of points that were unnecessarily involved in the discussion, although only one was really in dispute.

Do you conceive that if a servant of an inventor, who is employed to make experiments for him, discloses his invention to the public, such disclosure will prevent the inventor obtaining a patent?—If it is publicly disclosed, it certainly would either induce the Attorney General to refuse the patent being granted, or it would be ground for setting the patent aside afterwards. What constitutes a public disclosure has never been accurately defined; any sale from one person to another is an established criterion; and less than that will do, but how much less is undecided.

Would it be any defence to shew the court that the invention had been disclosed by the inventor to his servant, with the view of making experiments?—Certainly not; that is to say, the disclosure to the servant would be allowed, but a real publication by that servant would be held fatal. I suppose that such a servant would be liable to make compensation for the breach of trust, but yet he has a complete means of avoiding that remedy, for if he is bribed, or wishes to spite his master, he may get the publication made at second hand; for if he communicates the invention to a second person, and that second person goes and publishes it; there is no remedy against that second person; and the communication from the servant, which constituted the actionable breach of trust, was made in secret, and cannot be proved.

I knew a case of what might be termed a secret publication: a manufacturer had an invention which he intended to keep secret, and not to take a patent for it; but a rival in the same pursuit having succeeded in attaining the result, applied for a patent; a law suit and quarrel existed between the parties at the time, for they had recently separated from partnership, and had not settled accounts. To prevent the effect that this patent might have against the first named, he resolved to publish his invention, but he did that privately; for he sent a machine up to London, and set it to work before a number of people, who were told they might practise the invention, but it was so complicated that none were competent to understand or practise it, except a few who were servants, and agents of the publisher. If he had afterwards desired, from opposition or interest, to overturn his rival's patent, these competent persons would have been produced, to prove a real publication, but that was never attempted: and both parties went on working, until some years afterwards, when they made up the quarrel, and combined to prosecute others as infringers of the patent; it was then intended to prove in court, that the publication was a nullity, by calling only such witnesses as did not understand the invention when it was exhibited. The scheme failed and was abandoned before any trial, because the infringers had not followed the specification, but an improved machine, so different from it, that the patent could not be brought to bear against it, by any stretch.

About 20 years ago, some of the mechanists in Messrs. Marshall's flax mills at Leeds, invented the machine now generally used for heckling flax, preparatory to spinning; one of them applied for a patent for it, but was opposed by a Mr. Murray, who had been occupied with the same object. The Attorney General, being unable to find out the similarity that really existed, allowed the patent to pass; whereupon, before the date of the patent, Mr. Murray presented to the Society of Arts, the same model that he had exhibited in opposition.

So that in point of fact an inventor having occasion to employ persons to make experiments, has nothing to trust to but the good faith of those persons?—Certainly not; hence inventors almost always keep the secret to themselves, and continue in the dark, until they have got their patents. That is the great reason why we see such a number of patents for absurd projects; the projectors usually find out their mistake within a short time after they disclose the secret, and hear what remarks are made upon it, often before they have made an actual trial, and many would then drop their patent, if they had not incurred almost all the expense of it, before they found out their delusion; I have continually advised patentees, who have brought old or absurd inventions to me, in order to make specifications to patents previously obtained, that it was not worth the trouble and expense of merely specifying, and they had better desist; but they have rarely done so, because of the expense they have incurred; and when I have urged the utter worthlessness of their patent if they did complete the specification, they have sometimes acknowledged it; but said perhaps they might nevertheless sell the patent to some one who did not know that fact.

In one of these cases an office copy of the specification I had made was afterwards sent to me by an attorney, to get my opinion on the goodness of the patent, and the value

value of the invention, for a client of his who was in treaty for the purchase ; I knew the patent was good for nothing, but as I came by that knowledge in the course of confidential communication with the patentee, at the time of making his specification, I had no right, as a professional agent, to make use of that knowledge against his interests. On the other hand, as I might probably, by making search for the new party who asked my advice, have found out the same defect, even if the patentee had not previously communicated it, it was not right to conceal it. Under this embarrassment I took a middle course, and returned the papers, saying, that as I had prepared the specification, I must decline giving an opinion on what I had done myself ; but as it was known that I make no such rule in other cases, the attorney at once suspected the fact.

One great object of the arrangements I have proposed in applying for patents, is to give the inventor every chance, if he is under a delusion, of finding out his error, and abandoning his demand, before he has incurred a great part of the expense for a patent. I am confident that one half the patents now passed would be so withdrawn under the regulations I have proposed, although probably a double number of applications and deposits would be made.

Might not a part of the expense of trials on patent rights be saved, by calling on the parties to give notice to their opponents of the points on which they intend to rely in the course of the trial ?—That would be of great importance, but would be rather difficult to enforce ; because, although a patentee comes into court as plaintiff, on the infringement of his patent right, yet when defence is set up that his patent is bad, he becomes in effect defendant thereof ; hence it would be difficult to decide which party should give such notice. Patentees have constantly to prepare expensive evidence, and models, for points which are not ultimately called for by the court, and yet it cannot be foreseen what will be called for, and therefore every thing must be provided for the trial. I have not been called as a witness in a majority of cases in which I have prepared myself, and attended in court, after having put the parties to a considerable expense for models, and apparatus and assistants to make experiments, as well as for my own trouble ; and other professional men whose attention had been directed to the same points with myself, have also been waiting in court at the same time, but have not been called. That was the case in Crosley's action, to which I have referred ; there were several witnesses who had prepared themselves on particular points, but who were not called ; and further, I and others who were examined, had been obliged to prepare to answer many questions that were not asked, and some felt deficient in knowledge of particular points on which they were examined, all for want of previous knowledge of what inquiry would be made ; the expense would not have been so great, if effectual previous notice had been given of what points would be inquired into.

If an invention is discovered in a foreign country, a man may bring it over to this country and obtain a patent for it ?—Yes, he may have a patent for "an invention communicated to him from a person residing abroad," provided such invention is not known or in use here.

Is that advantageous or otherwise ?—Decidedly advantageous to us.

Why are you of that opinion ?—From the fact that we have derived almost as many good inventions from foreigners, as have originated among ourselves. The prevailing talent of the English and Scotch people is to apply new ideas to use, and to bring such applications to perfection, but they do not imagine so much as foreigners ; clocks and watches, the coining press, the windmill for draining land, the diving bell, the cylinder paper machine, the stocking frame, figure weaving loom, silk throwsting mill, canal-lock and turning-bridge, the machine for dredging and deepening rivers, the manufacture of alum, glass, the art of dyeing, printing, and the earliest notions of the steam engine, were all of foreign origin ; the modern paper-making machine, block machinery, printing machine, and steam boats, the same ; there are a multitude of others, that never have risen to any importance in the foreign countries where they were first imagined, because the means of executing and applying inventions abroad are so very inferior to ours. In almost all the above instances, we have so much improved and perfected what was brought into this country from abroad, that although they soon became important means of national wealth to us, the foreigners made little or nothing of them by themselves. Even after they got them back again in the improved state to which we had brought them, although they received their crude ideas matured, like children sent home, after having been well educated, and become full grown, by boarding for years, without expense, at a better school than home,—still they have not been able to set them to work so extensively and profitably as we have done. I am of opinion, that

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the appropriation to individuals for a time by patent, is essential to induce the necessary cultivation and training of foreign inventions to improvement; to effect their naturalization, or, as it were, to teach them the language of our nation; and also to insure the application of the crude ideas we may import from foreigners, to real use in business.

Do you not think that inventions for which patents have been taken out in a foreign country, would be almost sure to come into this country soon, without a patent?—Certainly; all knowledge will find its way into every country in time, but it is good policy to endeavour to accelerate the influx of foreign knowledge; I think that on the average of the operation of patent rights, they very greatly facilitate the establishment of new inventions to become branches of trade, as I have before explained, and I see no difference in any of those reasons, whether a new invention originates amongst us, or amongst foreigners. Even supposing there is no patent abroad, I conceive it puts our manufacturers under no disadvantage to be paying such a small tax as is usually levied by a patentee for licenses, when foreign manufacturers may not be paying such a tax; because I feel confident of the fact, that under the stimulus and protection of a patent in Britain, the patentee, either by himself, or by men of talent who he can then afford to employ, will improve the manufacture that is to be effected by the new invention, much more rapidly than can be done by the foreigners who are at work in the same course of improvement, without that stimulus, and with inferior means of execution; hence the tax the British patentee levies, will never be felt at all. If there is a patent abroad to stimulate corresponding exertions to improvement there, then the foreign manufacturers will be under a corresponding tax; but such taxes are in all cases a mere trifle, compared with the profits that manufacturers derive from the adoption of new inventions. It is obvious that we should not get even the bare idea of a new invention so soon, if we do not offer to grant a patent for it, as with that premium or bounty for its importation; also that in the latter case it will come to us in the most complete form that it has acquired abroad. When we do get an idea completely without a patent right it is of no use for any one to incur the expense of cultivating it. The policy of granting the exclusive privilege for a foreign invention, stands on precisely the same ground as that for any other first idea. I can say, from long experience, that the new inventions we get fresh imported from abroad, are to the full as crude, and in as much need of future expensive cultivation, as any of the secret productions of our own inventors, when they first disclose them. I conceive, that in all cases, the operation of patent law is advantageous to the cultivation of first ideas, up to that point of practicability when they can be established as articles of trade and commerce; and also, after that perfection of invention is attained, the operations of trade, founded on new inventions, are very much facilitated by some person having an interest to devote all his energies to that trade, to create an extensive demand, and organize the means of supplying the same. The public usually come into practice in that new trade, (under a trifling tax,) as soon as ever they please, and if good laws were enforced, they would always acquire a complete right and possession at the expiration of the patent; not merely of the bare notion of how they might go to work to establish a new trade, but they would be put in full possession of an organized trade, which they would never have acquired in such perfection, and would not have acquired at all until a later period, if its cultivation towards perfection as an art, and establishment as a trade, had been left to the languid and desultory exertions of every one who might choose to do a little, *con amore*, without an exclusive benefit. Independently of mere pecuniary interest, men of genius are greatly stimulated to exertion, by the hope of having a right of property in, and control over, their own productions; for the same feeling exists that they have towards their children; and the absence of that confidence of property and right, induces the same capricious, negligent, unconnected, and casual attempts at cultivation of new ideas or inventions, as is observable in men with the education and advancement of their children, when the legitimacy is doubtful.

Supposing an article patented, and actually brought into efficient use abroad, is there any benefit to this country in allowing persons to introduce an article in that state, and to have a patent for it?—Supposing the invention to be already as perfect as we could make it, there would be little advantage in allowing a patent for it, except that as it still requires to be made known, and brought into use amongst us, in spite of ignorance and prejudice, that bringing into use will be accelerated by the exertions of a patentee; nor do I see any equivalent disadvantage in granting a patent, because I know the taxes, levied by patentees, are always so slight.

Might

Mr.
John Farey.8 June,
1829.

Might not the public be benefited, by using it without a patent?—They would not get it into use so speedily without a patent, even if it were imported in a stage of high perfection as to invention, because there is a prejudice against the adoption of all new practices, that must be overcome; a patentee will labour to get over that for his own interest; but every successive importer who has adopted a new invention from abroad, without a patent, will of course keep it a secret as long as he can, and will disguise and deceive as much as possible, by saying, “that the invention which he got from abroad, (and which others may get,) proved good for nothing; he lost money by it, and it only served to set him to work on the subject, and he has made a new invention;” such false statements will pass current, and retard the adoption a long time. If we suppose the British patentee of a foreign invention, wished to keep it in his own hands, and would not grant licenses, then that must be because he has means of supplying the public demand very freely, or else that exclusion would be destroying his own property.

It must not be overlooked, that the assumption of the invention being very perfect when it is first imported here, implies that it has been a long time in existence, and has been long cultivated in secret by foreigners, because they are so much slower at such work than we are: if we had offered the premium of a patent right for its early importation amongst us, there is every probability that we should have received it years before, in a crude state; either from the inventor himself, when it was in its earliest stage of infancy, if he kept it secret, or else from commercial speculators, if it were openly known. Having thus obtained the crude invention, we should have set our great means and powers to work on its perfection and cultivation, at the same time as the foreigners began, and they would then have had no chance with us, to have attained the same perfection in the same time. I could cite many cases in support of these opinions.

Veneris, 12^o die Junii, 1829.

Thomas Aspinwall, Esquire, called in; and Examined.

T. Aspinwall,
Esq.12 June,
1829.

YOU are Consul of the United States of America, resident in London?—I am.

Are you acquainted with the American law of patents?—Yes.

Is the American law pretty nearly the same with the English law?—In many respects it is very different.

What is the term for which patents are granted in America?—Fourteen years.

Do they grant patents for any shorter period, at the option of the inventor?—No.

Does any considerable length of time elapse, between the application for a patent and obtaining a verification of it?—No more than is necessary for the simple transaction of the business. It may be got through in a day if persons will attend to it, and the length of the papers admit of it. The Attorney General is allowed fifteen days for examining them, in order to ascertain whether they are conformable to the statute, but the great simplicity of the documents enables him to perform this duty with the utmost promptitude in ordinary cases.

Are they required to enter an accurate description of the invention in any public office?—They are.

Is that description secret or open?—It is open. The description must be such as to distinguish the invention from all others that have preceded it; and if it be a machine, it must be in such terms as to enable a workman to make it; or if it be a composition of matters, so that it may be compounded; this description is made a part of the patent, and must not refer to drawings or the model, if it can be avoided. Wherever the requisite clearness cannot be attained without such references, the applicant furnishes two sets of drawings, one of which is attached to the letters patent.

Will you have the goodness to describe the mode of application for a patent in America?—The first step in the process is the payment of about 6*l.* 15*s.*, or thirty dollars of American currency, into the patent office. The applicant obtains duplicate certificates of that payment, and takes one of them to the office of the Secretary of State, to whom, at the same time he presents a petition applying for a patent for his invention, describing it shortly. He annexes to the specification, which generally accompanies the petition, an oath, that he is the true discoverer of his invention, and that he is a citizen of the United States; those two facts are

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all that is required in the affidavit. The Secretary, if there be no interfering application, immediately assents to the letters patent being granted, and the papers are then taken by the applicant to the patent office, where the specification, signed by himself, and attested by two witnesses, is then lodged, accompanied with drawings; and if it be a description of a machine also, with a model, if the Secretary directs it shall be so, in order that there shall be no mistaking the exact nature and extent of the invention. This whole process may be accomplished in half a day if there were a person on the spot to attend to it, and if the necessary writings could be made within that time. When the letters patent are prepared for signature and sealing, they are submitted to the Attorney General of the United States, who within fifteen days, if he finds them to be conformable to the Acts of Congress on the subject, returns them to the Secretary of State, who presents them to the President for signature, and causes the seal of the United States to be affixed to them. After being recorded in the books of the proper office in the department of state, the letters are delivered to the patentee or his order.

Are any means taken to ascertain, whether the person has given an accurate description of his invention beyond that of requiring a model?—No, he may be told by the superintendent, or other officer of the patent office, that his description is imperfect. It is, however, not very likely, in the present state of the patent law, that the letters patent will be refused on that ground, but still they may be avoided afterwards in a court of law on account of imperfections in the specification.

Is it at the option of the Secretary of State to compel him to give a model or not?—Yes; he is always obliged to furnish drawings as a matter of course, and a model at the option of the Secretary.

Does it often happen that models are required, or are they content with drawings in most cases?—They require models whenever the machine is complicated.

Is the inventor himself apt to desire, that a model should be deposited in order to secure the invention to himself?—From personal knowledge I cannot say.

Are patents often set aside in America from imperfection in the description?—Sometimes, but not very frequently, they have been set aside for want of form in the specification; they have been set aside for some very substantial cause, such as the invention not having been an original one; that it was a second discovery of the same thing, or that the specification, in some part of it, only claimed what was previously known.

Are they often set aside for an imperfect description of the way of making the machine?—I know of but one case of that kind, they may be annulled for claiming or including more than the invention.

Are piracies very frequent?—They have been attempted, but a reference being always easily made to the patent office, and in such a case if it be found on examination that the invention has been patented in due form, there is no difficulty in getting damages in a court of law.

What is the mode of trying a patent right in America?—After a patent has been issued, the right of the patentee may be tried in two ways under the statute, either upon a rule of court to shew cause why the patent should not be annulled, founded on the affidavit of any person filed in the district court of the district where the patentee resides, and alleging that the patent was obtained surreptitiously, or upon false suggestions; or, secondly, in a suit brought by the patentee for an infringement. In the latter case, the defendant may give in evidence under the general issue, any special matter of which notice is given thirty days before trial, tending to prove that the patentee's specification does not contain the whole truth relative to his discovery, or that it contains more than is necessary to produce the desired effect; which concealment or addition shall fully appear to have been made for the purpose of deceiving the public; or that the subject of the patent was not originally discovered by the patentee, but had been previously in use, or described in some public work, or that he had surreptitiously obtained a patent for the discovery of some other person.

Then the *onus probandi* falls upon the person opposing the patent?—Yes, in the latter mode of trial. Besides those two methods of trying a patent right, it is conceived that a *scire facias* would lie at common law to compel a patentee to show cause why his patent should not be avoided. The patent right might also be tried in Chancery under an application for an injunction.

In the case of a piracy, in which the patentee prosecutes the person infringing his right, is the process for recovering damages easy or not?—It is as easy as to bring to a close any other suit at law.

Is

T. Aspinwall,
Esq.12 June,
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Is it in America the most common way for a person to attack the patent in a court of law in the way you have described, in order to set it aside, or at once to pirate the invention, and leave the patentee to seek his remedy in a court of law?—I think it most general to pirate the invention whenever the patent is supposed to be invalid, but not otherwise; because in that case, if it were a valuable invention, and if it were also one that was likely to excite public curiosity, or incapable of being secretly put in operation, the patentee would immediately come down upon the invader of his rights with a suit at law, and recover treble damages. Most of the reported cases are suits for infringements.

Are there many cases within your knowledge, where patentees have brought actions and failed in recovering damages?—I am not able to say definitely; five or six, certainly.

Does a patent run over the whole of America, or only over one particular state?—It goes over the whole of the United States.

You state, that for three years it is liable, in the district courts, to be questioned; is a patentee safe after three years?—After three years he would not be liable to be called into court in that way, at the instance of any person who chose to question his rights; but when his patent is infringed, he must either submit to the infringement, or else he must bring it into court; but previously to his patent being granted at all, if there be a conflicting application, the parties would be required, each of them, to nominate an arbitrator, the Secretary of State would nominate a third, and it would be left to this arbitration to decide which of the claimants was entitled to the patent.

In trials of patents, are arbitrators ever appointed by the court to settle them?—They may be by consent of parties, but not without the consent of parties; they would examine witnesses, experienced persons, as in other cases.

Does the inventor send in his specification to the Secretary of State finished at his first application?—It is not necessary that he should exhibit his specification to the Secretary of State, except perhaps the form of the documents may make it convenient to annex them all together.

How long afterwards would it be necessary to lodge the specification?—He may lodge it immediately, as soon as he has got the assent of the Secretary of State that the letters patent should issue; but it is not necessary that the Secretary should know any thing at all of the merits or the justice of the application, he depends entirely upon the allegations of the parties concerned.

How soon can he be compelled by law, after his patent is granted, to put in his specification?—If he does not choose, he may never do it; but after paying the thirty dollars, the patent almost always issues as a matter of course. There is no obligation upon him to furnish any specification, but if he does not, he cannot get his patent.

Is the specification given in before the patent is ratified?—Yes; the Secretary of State of course orders the patent to issue upon the petition and affidavit. It will not however issue, unless the specification be lodged, because the latter is inserted in it, or forms a part of it. There is no obligation to lodge the specification, if the party does not choose to take out the patent. The patent would not be issued without the specification, but the specification must be lodged first.

You have said that a person can obtain a patent in a single day?—Yes, if the papers are completed and approved by the Attorney General.

When he has received the order from the Secretary of State's office, would that be a protection to him till the patent is taken out?—It would be a protection to him in a certain way, it would secure him against interfering applications. But supposing him to delay a year, during which another person uses the invention, his specification happening not to be lodged in the patent office till the expiration of a year, I should consider that he would not be entitled to any damages for an infringement of his patent during that time, but he still would be entitled to his patent.

What is the usual time that inventors take to make out their specifications?—It varies of course very much according to the complexity or length of the specification.

Does the patent right take effect from the moment the Secretary of State has signified his willingness to grant the patent, or from the time when the patent is sealed?—It runs from the time when the letters patent are dated, at which time they are in a state to be delivered to the patentee.

Supposing an inventor was to delay putting in his specification for several years, would

T. Aspinwall,
Esq.

12 June,
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would the public still be precluded from using the invention?—Not at all, he would have no patent. It is barely possible that an injunction might be obtained if the delay were unavoidable.

Will you have the kindness to explain, how far a patentee is protected in the interval between obtaining the assent of the Secretary of State and the completion of his patent, by lodging the specification?—The answer to a certain degree must be hypothetical, because the patent is almost always completed; and the specification and petition go together, at least they are all furnished at the same time, therefore, practically, I doubt whether I shall be able to answer the question; but as a matter of inference, I should say, that as the patent can have no force previously to its existence, if the completion of the patent were delayed during the interval of delay, the invention might be made use of by any body, unless perhaps specially restrained by an injunction from Chancery.

When the patent is completed, then would the individuals who had availed themselves of that invention, during the interval between the Secretary of State's assent and the completion of the patent, be prohibited from continuing to avail themselves of that invention?—Decidedly so; the pirate would be precluded from any use of it, because a patent in America, being granted only to the inventor, the right to the monopoly is complete the moment the letters patent issue; and the inventor alone, or his legal representatives, would have a right to make use of the invention.

Can an individual, having obtained a patent, sell that patent to another?—Yes, and it also descends to his heirs; he may dispose of it to any body without limitation. It is just like any other property. There is a circumstance somewhat material that I would mention, if an inventor dies previously to securing a patent, his heirs, or even his devisees would have a right to take out the patent after his death, in the name of the executor or administrator as trustee.

You have stated that the specification and the petition generally go together?—They generally go together as a matter of convenience.

But you say that the Secretary of State does not require any description in order to give his consent to a patent?—He does not require it to be presented to him, but it is lodged in the patent office, which is a branch of his department. As a matter of convenience it generally accompanies the petition; the whole of the writings, prepared by the applicant, are generally on two sheets of paper.

You are perhaps aware, that in England a patent cannot be granted to more than five persons; is there any limitation of that sort in America?—There cannot be five inventors of one thing; but the patent right may be disposed of to any number without limit.

Are American patents granted to foreigners?—If they have resided two years in the United States. A foreigner who has not resided two years, cannot get a patent as a matter of course, under the patent law; but Congress has the power of dispensing with the two years residence by special act.

Are persons taking out a patent in America, under any condition, that they shall not take out a patent in any other country?—Not at all.

Supposing that several months elapsed before the specification was put in, and the patent completed, have other persons power by obtaining access to the patent office, of knowing what the inventor is about?—A person would have the same means of discovering it that he would have of discovering the business of any other office, but it is not open to the public; I dare say there would be no particular secrecy made use of on the subject; but still it is not customary to make applications at the patent office, with the view of crossing the purposes of the inventor, because there cannot often be two persons claiming patents as inventors of the same thing. The principle as I have remarked before, of the American patent law, is somewhat different from that of England. It is granted there as a reward to the inventor. Here a patent is granted as a reward to any person for bringing the invention to the knowledge of the public, whether he be the inventor or not.

In what part of the United States is a patent right tried?—It is tried where the patentee resides, if he is to be called upon to shew cause why his patent should not be avoided, but it may be where either party resides in other cases.

If the patentee brings an action for an infringement of the patent, is it at the option of the patentee where it shall be tried?—It must be tried at the place where the person sued resides.

Is there any mode by which an English patent can be afterwards patented in America?—Not if it has been known or used here. There is a peculiarity in the patents granted to Americans. They are not required to make affidavit that the invention

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invention has never been made known or used in any foreign country. A foreigner is obliged to make that oath, but an American may be presumed, of course, to have originated all his inventions within his own country. It is probably, however, an accidental difference between the two oaths.

Is he allowed to get a patent for an invention from a foreign country which he has not himself invented?—He cannot get a patent for it. There are no patents of importation.

He is obliged, in all cases, to swear that he is the inventor?—Yes.

Supposing an Englishman were to invent something that he believed would be particularly useful to the United States, must he go to America in order to take out a patent for it?—He must go and reside there two years before he could obtain a patent as a matter of course, but by petition to Congress he might probably have the two years residence dispensed with. Foreigners have obtained special acts of the legislature, directing patents to issue for them even when they have not resided at all in the United States. An instance in point is that of Brown's gas engine, but that was the last; and a member of Congress, who had been upon the committee that brought in the Bill, said the dispensation was granted under a misapprehension that the petitioner was residing in the country.

How long ago was that?—Four or five years.

You have stated, that the specification is usually open to the public, are there any cases in which the legislature interferes to require it to be kept secret?—None.

Supposing the invention is not used for a great number of years, does the party lose his patent?—No, his patent is good for the fourteen years; he is not required to carry it into use at all. It is probable, that if he were to commence an action against a person for an invasion, he would, in that case, get very little damages. That being the natural course I suppose, it is considered not to require any particular provision.

Are patentees in America in the habit of granting licenses to persons to work the invention?—It is very common.

Are they obliged, if they grant it to one person, to grant it to others?—No; it is entirely optional.

Do you know whether licenses are sometimes granted to particular parties, on condition that they shall not be granted to others?—I am not aware of any circumstance of that kind.

Can you state whether, from the cheapness of patents in America, a very great number are taken out?—About two hundred annually.

Is the number found to be any inconvenience; is there any complaint of the number of patents that are taken out?—Not at all.

You have stated, that thirty dollars is paid on the first application; is that the whole expense of the patent?—That is the whole expense. The party may possibly go to a lawyer to have his petition drawn up, and to have his papers put in order, for which the highest rate of compensation there is about 4*l.* 10*s.*; so that the whole expense of a patent would seldom exceed about eleven or twelve pounds; the thirty dollars is all the official expense.

If a person makes an improvement upon his original invention, must he take out a new patent for that?—Yes; he cannot add that to his old patent.

After the patents are taken out, are they placed in any office of record, where every one has access?—Yes; and they have also a model office, which is at present a respectable museum, where all machines are deposited.

In most cases where a patent is taken out for machinery, is a model deposited?—Yes.

In chemical processes, what is done?—In chemical processes they give the different ingredients whenever they are required; and those are deposited in the same way.

Where patents are granted for chemical inventions, is any experiment made to know whether the result can be produced?—No; unless the head of the patent office chooses to do it for his own amusement.

Supposing he does, and finds that the thing does not answer, would the patent be refused?—If any person choose to call upon the patentee, to shew cause why his patent should not be avoided, on the ground that it did not answer the purpose suggested in the specification or petition, the patentee would be obliged to prove that it did so.

That is a process in a court of law?—Yes.

T. Aspinwall,
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Attended with the same expense that any other action at law is?—It is a little more summary; a motion is made, on affidavit, to the court, and a notice issues to the party, at the discretion of the judge, to appear and show cause; and upon solemn argument, or in case the patentee fail to appear and shew cause, the rule may be made absolute, and the patent declared void.

Is there any complaint made of the incompetency of the courts, in some cases, to try those questions of patent rights?—I am not aware of that; the patent law prescribes the remedies. It is a matter regulated by statute, and of course the section of the law would indicate at once whether the court had jurisdiction or not.

As very often questions must arise, in which a considerable degree of science is required, to ascertain whether there has been an infringement or not, or whether the invention is a new one or not, have you ever heard it said that juries and judges are incompetent to try those questions?—I have not heard much complaint upon that subject; but I have some slight recollection of a cause that was tried in that way, and I remember very well that the counsel acknowledged their own incompetency.

In case it is attempted to set aside a patent, can such a prosecution be brought more than once by any party?—I do not think there is any legal provision against that; the party who had failed the first time, would of course again be saddled with costs if he failed the second time. The expense is the only general remedy against it.

Mr. John Isaac Hawkins, called in; and Examined.

Mr.
J. I. Hawkins.

12 June,
1829.

HAVE you any information to give to the Committee with regard to the Spanish law of patents?—I have read over the Spanish patent law, and extracted the only points which I think require any consideration. They are contained in a law passed by the Cortes on the 2d of October 1820, and which was sanctioned by Ferdinand the 7th, on the 14th of October 1820, and they are as follows:—The inventor of a new machine or process is entitled to a patent for ten years. The improver of an old machine or process can only have a patent for six years; and the importer of a foreign invention only five years. An act of the Cortes can extend the period, in particular cases, not exceeding in the whole, fifteen years to the inventor, ten years to the improver, and six years to the importer. The whole expense of the patent is, to the inventor 2,000 reals, to the improver 1,200 reals, and to the importer 1,000 reals. One half to be paid at the time of petitioning, the other half on receiving the patent; the specification to be presented at the time of petitioning. The specification is open to public inspection, except in particular cases at the discretion of the government. Any number of partners may hold and work a patent. If the Committee should wish for further information upon this subject I would beg leave to refer them to a work, intituled, "*Traité des Brevets d'Invention, &c.*" By Augustin Charles Renouard," which was published at Paris, in the year 1825. There is one point in this Spanish law which I would beg leave to make an observation upon, which is the provision giving different periods to different classes of applicants. It appears to me next to impossible to distinguish between an inventor and the improver of an old invention, and therefore I think such a distinction would create a great difficulty; but there is a broad distinction between an inventor and the importer of a foreign invention, and it might be worthy of consideration, whether a difference of period should be made between the inventor and the importer of a foreign invention.

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APPENDIX.

PAPERS DELIVERED IN BY JOHN FAREY, ESQ.

8th June 1829.

Appendix, (A.)

British Law of Patents for Inventions.

A LIST of the various ACTS of PARLIAMENT, by which the operation of exclusive Privileges, granted by Royal Charters and Royal Letters Patent, is limited and restrained, and other Acts by which the granting of Royal Letters Patent is authorized and regulated; also Acts for promoting and encouraging Improvements in Arts and Manufactures, by granting Rewards to Inventors; and by prolonging the Terms of their Patent Rights;

Followed by, A LIST of CASES of TRIALS AT LAW, respecting Patent Rights, which have been reported and cited, as containing the principal decisions of the Courts of Justice on the Law relative to Patents for inventions.

Note:—All the articles in this list, which Mr. Farey has collected from general reading, without being able to verify them by reference to authentic documents, (and also his own remarks) are printed in Italic, to distinguish them from the others, which have been compiled from official sources.

Magna Charter,
1225. 9 H. III. s. 1. c. 30.
confirmed by
1382. 5 Ric. II. stat. 2.
c. 1.

Merchant strangers (being no enemies) coming into this realm shall be well used.

All merchants (if they were not openly prohibited before) shall have their safe and sure conduct, to depart out of England, to come into England, to tarry in, and go through England, as well by land as water, to buy and sell, without any evil Tolts; except in time of war.

1328. 2 Edw. III. c. 9. All staples shall cease, and all merchants may come in, and go out, with their merchandize, without any disturbance.

The staples beyond the sea and on this side, ordained by Kings in times past, and the pains thereupon provided, shall cease. All merchants, strangers and privy, may go and come with their merchandizes out of and into England, after the tenor of the Great Charter.

1335. 9 Ed. III. s. 1. c. 1.
enforced by
1350. 25 Edw. III. stat. 4.
c. 2.
also confirmed by
1353. 27 Edw. III. stat. 2.
c. 2.

Merchant strangers may buy and sell within this realm, without any disturbance.

All merchants, strangers, and denizens, and all others, of whatsoever estate or condition, that will buy or sell corn, wines, aver de pois, victuals, wares, and all other things vendible, from whencesoever they come, by foreigners or denizens, at whatever place it be, may freely sell, to whoever they please, foreigners or denizens; except the King's enemies. Notwithstanding any charters, usages and customs to the contrary, for the same are to be held of no force, but as things granted to the damage of the King, and the great men of his realm, and to the oppression of the commons; saved always to the King the customs due on the merchandize.

1340. 14 Ed. III. s. 2. c. 2. All Merchants (being no enemies,) shall come into the realm, and depart quietly.

The provisions of the Great Charter are confirmed; saving reasonable customs and subsidies to the King, and free customs granted to the City of London, and to other cities and towns.

1376. 50th Edward the Third. *John Peachie of London was severely punished for procuring an exclusive license under the great seal, that he only might sell sweet wines in London.* Coke's Institutes, part 3. chap. 85, against Monopolists.
Rot. Par. nu. 33.

1378. 2 Ric. II. s. 1. c. 1. All merchants may buy and sell, within the realm, without any disturbance.

1382. 5 Ric. II. s. 2. c. 1. Merchant strangers may come into, continue in, and depart forth out of the realm.

1387. 11 Ric. II. c. 7. All merchants, aliens and denizens, may buy and sell within this realm without any interruption, according to the 9th Edw. III, and 25th Edw. III.

1387. 11 Ric. II. c. 10. Neither letters of the signet, nor of the King's privy seal, shall from henceforth be sent in damage of the realm, nor in disturbance of the law.

1399. 1 Henry IV. c. 6. In a petition to the King for grants of lands, offices, &c. the value shall be expressed.

explained by

1400. 2 Hen. IV. c. 2. exp.

limited by

1404. 6 Hen. IV. c. 2. exp.

All they that do demand of the King grants of lands, offices, rents or any other profits, shall make express mention in their petitions, of the value of the thing so demanded, and also of that which they have had of the King's gift (or of his predecessors) before; and unless that is truly done, and duly proved, the King's letters patent thereof made (on such defective petitions) shall not be of any force, but shall be annulled, to the punishment of them which have so done deceit to the King.

1399. 1 Henry IV. c. 8. Assise maintainable by the disseisee against the King's patentee of lands.

regulated by

1429. 8 Henry VI. c. 16.

In case any lands or tenements be granted by the King's patent, without title being found by inquest or otherwise, where the King's entry is not given by law, they that be put out, or disseised of their freehold, shall have a special assise of the Chancellor's grant, without other suit being made to the King in that behalf. And in case that they which be put out, or disseised, do recover against the persons having such patents, they shall recover their treble damages.

1402. 4 Henry IV. c. 4. The King will grant no lands, &c. but to such persons as shall deserve them.

The King will abstain from making any grants except to those persons who deserve them, as the same shall appear to the King and his council; others who make demands for undue grants, shall be punished by the King with advice of his council, and such grants shall be void.

1439. 18 Henry VI. c. 1. Letters Patent shall bear the date of the delivery of the King's warrant into the Chancery.

Every warrant for letters patent hereafter sent by the King to the Chancellor, the day of the delivery of the same to the Chancellor, shall be entered of record in the Chancery; and the Chancellor shall cause letters patents to be made upon the same warrant, bearing date the day of the said delivery in the Chancery, and not before in any wise. And if any letters patents be henceforth antedated, or made to the contrary of this Act, they shall be void.

1439. 18 Henry VI. c. 6. No lands shall be granted by Letters Patents, until the King's title be found by inquisition, duly made according to 8 Hen. VI. c. 16, and 36 Edw. III. c. 13.

1461. 1 Edward IV. c. 1. Confirmation of Letters Patent made by Edw. IV. to several persons, of offices.

1467. 7 Edward IV. c. 4. An Act for Grants made by King Edw. IV. since the first year of his reign. *exp.*

1496. *A patent was granted by King Henry the Seventh, to John Cabot, a Venetian, to go upon discovery of new Lands in America under English colours. In 1502 another such patent to John Gonzales. Also in 1506 a patent to an Italian, for making Alum, a new art which had been recently established in Italy.*

1514. 6 Hen. VIII. c. 15. An Act annulling second Letters Patents of Grants during the King's pleasure, making no mention of the first Letters Patents for the same things.

Any person making suit to the King, for grant of any lands, offices or other things before granted to any other during pleasure, (the first patentee being in life) shall express in his petition or patent, the tenor of the former patent, and in what manner the King hath determined his pleasure against the said first patentee; or else the second letters patent shall be void.

1529. 21 Hen. VIII. c. 12. An Act for making Cables at Burport in Dorsetshire, but not within five miles thereof.

Also, in 1533, 25 Hen. VIII. c. 18, for making Woollen Cloth at Worcester City, exclusively of the adjacent country.

1535. 27 Hen VIII c. 11. An Act concerning Clerks of the Signet and Privy Seal, and the offices and fees connected with, and incident to, Royal Grants by Letters Patent, or closed.

(¹) Every grant made to any person by the King, in writing with his sign manual, before being passed under any of his Grace's great seals, shall be first delivered to the King's principal Secretary, or to one of the King's Clerks of the Signet. (²) The latter shall, within eight days after receiving such bill so signed with the King's hand, make out and sign letters of warrant in the King's name, and sealed with the King's signet, to the Lord Keeper of the King's Privy Seal; and after due examination of such warrant by the said Lord, one of the King's Clerks of the Privy Seal, shall, within eight days after receipt of that warrant, make out and sign other letters of like warranty, to the Lord Chancellor, or other Keeper of the King's Great Seals, for the writing, and sealing with such seals as remain in their custody, of Letters Patent, or closed, according to the tenor of the warrant to them directed as aforesaid from the officer of the Privy Seal.* (³) Any person writing warrants or procuring grants under any of the great seals, after any other fashion, than as before specified, shall forfeit £. 10 for every bill passed contrary to the order hereinbefore prescribed; one half of the penalty to the King, and the other half to him who shall first sue for the same.

(¹) The fees payable, and the mode of receiving, and accounting for them, is also regulated.

(¹¹) The Lord Chancellor may at his discretion pass any thing by the Great Seal, and deliver the same, without paying any fees at the Great Seal, Signet and Privy Seal.

* Note. The proper date for such Letters Patent or closed, is not fixed, but is provided by 18 Hen. VI. c. 1.

1538. *In the 30th of Henry VIII. The manner of casting pipes of lead, for conveyance of water under ground, was first invented by Robert Brock.*

He was one of the King's Chaplains. Robert Cooper, goldsmith, made the instruments and put the invention first in practice.

1543. *In the 35th of Henry VIII. The first cast iron pieces of Ordnance that were ever made in England, were cast at Backstead in Sussex, by Ralph Page, and Peter Baude.*

The art of casting cannon in brass had been only recently established in England, about 1535. Cannon had been first used by the English by Edward III. at the battle of Cressy in 1346; and in 1383 by the Governor of Calais, but were not used in England till the siege of Berwick in 1505, and after that they became common.

1542. 34 & 35 Hen. VIII. c. 21. An Act for the confirmation of Letters Patent, notwithstanding the misnaming of any name, place or date contained in the same, *exp.*

See also 7th Edw. VI. c. 3, and 35th Eliz. c. 3. (*chiefly on grants of Church lands.*)

1542. 34 & 35 Hen. VIII. c. 10. A Bill for confining the making of Coverlets in Yorkshire to York City.

1547. 1 Edw. VI. c. 8. *exp.* An Act for the confirmation of Letters Patent, notwithstanding mis-recitals, or lack of inquisitions, or of certainty in valuing, *exp.*

Note. *This Act appears to avoid the previous provisions of 1st Hen. IV. c. 8, and 18th Hen. VI. c. 6.*

1549. 3 & 4 Edw. VI. c. 4. extended by 13 Eliz. c. 6. An Act concerning Grants and Gifts made by Patentees out of their Letters Patent.

The enrolment of patents is to be received in evidence, by showing an exemplification or constat of the roll, under the great seal, which shall be as good as showing the first patent itself.

1552. 5 & 6 Edw. VI. c. 24. An Act for confining the making of Felt Hats in Norfolk, to Norwich and Pulham.

1553. 7 Ed. VI. c. 3. An Act for the confirmation of Letters Patent of Bargains and Sales, by Hen. VIII. and Edw. VI. notwithstanding misrecitals of the particulars, *exp.*

1557. 4 & 5 Phil. & Mar. c. 1. An Act for the confirmation of Letters Patents made by the King and Queen, *exp.*

Note. *A patent was granted in the reign of Philip and Mary to the Corporation of Southampton, for the exclusive importation of Malmsey wine at that place. This was set aside in the 2d and 3d Eliz. by all the Judges, as being contrary to statutes (viz. Magna Charta; 9th Edw. III; also 14th, 25th, 27th & 28th Edw. III; 2d Ric. II. c. 1, and others,) and against the freedom of trade.*

Coke's Institutes, part 3. c. 85.

1570. 13 Eliz. c. 6. An Act that the exemplifications, or constat of Letters Patent, shall be as good and as available in Law as the Letters Patent themselves.

A supply of the 3d & 4th of Edw. VI. c. 4; and is extended to all patents since Hen. VIII.

1572. *Bircot's case, decided at law in the Exchequer Chamber, 15th Elizabeth, Easter Term. A privilege concerning the preparing and melting, &c. of lead ore.*

Coke's Institutes, 3d part, c. 85.

" A privilege, to be consonant to law, must
" be for what is substantially and essentially
" newly invented; if the substance was in
" being before, and a new addition made
" thereunto, though that addition make the
" former more profitable, yet it is not a new
" manufacture in law. It was there said, that
" that was to put but a new button to an old
" coat, and it is much easier to add than to
" invent; it was also there resolved, that if
" the new manufacture be substantially in-
" vented according to law, yet no old manu-
" facture in use before, can be prohibited."
This case was cited during the trial Boulton and Watt against Bull, in 1795, by Mr. Justice Buller, who said, " It has never been directly decided, that a patent for an addition may be maintained; but if the button were new, I do not feel the weight of the objection

" that the coat was old; in truth, arts and
" sciences at that period were at so low an
" ebb, in comparison with their present state,
" that I do not think that case ought to pre-
" clude the question." And by Lord Chief Justice Eyre, who said, " The principle on which that case was determined, has not been adhered to." Also cited during the trial of Hornblower against Boulton and Watt in error, 1799, by Mr. Justice Grose, who said, " If that decision were to be considered as law at this day, it would set aside many patents for very ingenious inventions, in cases where the additions to manufactures before existing, are much more valuable than the original manufactures themselves. Lord Coke's opinion, seems to have been formed without due consideration, and modern experience shows that it is not well founded."

1576. 18 Eliz. c. 2. An Act for confirmation, as well of all Grants made to the Queen's Majesty, as of Letters Patent made by her Majesty to others.

1591. *A patent was granted by Queen Elizabeth, for printing a book. Printing began in England, 1474.*

1593. 35 Eliz. c. 3. An Act for explanation of a statute made in the 34th year of King Henry the VIII. as well touching Grants made to his Majesty, as for confirmation of Letters Patent made by his Highness to others, (chiefly of abbey lands.)

1601. 43 Eliz. c. 1. exp. An Act for confirmation of Grants made to the Queen's Majesty, and of Letters Patent made by her Highness to others.

Letters patent shall be expounded beneficially for the patentee; patents decreed to be void by Act of Parliament, or by courts of law; monopolies.

1601. 20th November. *A great debate took place in the House of Commons concerning monopolies.*

See Parliamentary History, vol. 4, p. 452.

It appears from the speeches made on this occasion, that an excessive public grievance then existed, from the multiplication of letters patent for monopolies of almost every branch of trade and manufacture. The following were mentioned, amongst others: salt, aquavitæ, vinegar, alegar, train-oil, oil of blubber, brushes, bottles, pouldavy, oade, starch, Irish yarn, calf skins and felts, steel, leather, cards, glasses, saltpetre,* &c. &c. There was very little difference of opinion as to the grievances, for each speaker cited some from his own knowledge; but as to the remedy, they debated whether it should be by bill, or by petition to her Majesty; the latter was adopted.

The following is an extract from the speech of Mr. Francis Bacon, the attorney general (afterwards Lord Chancellor Verulam.) "The Queen, by her prerogative, has both an enlarging and restraining power, for she may set at liberty things restrained by statute law, or otherwise, or she may restrain things which be at liberty; for the first, she may grant *non obstante* contrary to the penal laws; for the second, if any man out of his own wit or industry, finds out any thing beneficial for the commonwealth, or brings in any new invention, which every subject of this kingdom may use, yet in regard of his pains and travel therein, her Majesty perhaps is pleased to grant him a privilege to use the same, only by himself or his deputies, for a certain time; this is one kind of monopoly. Sometimes there is a glut of things, when they be in excessive quantity, as of corn; or sometimes there is a scarcity, or a small quantity; and accordingly her

"Majesty gives license of transportation or of importation: this is another kind of monopoly. These, and divers of this nature, have been in trial at common pleas upon actions of trespass, and if the Judges find the privilege good, and beneficial to the commonwealth, they will allow it; otherwise, disallow it. Since the last Parliament, her Majesty herself hath given commandment to her attorney-general, to bring divers of them into the Exchequer; and at least fifteen or sixteen have been repealed, some by her Majesty's own express commandment, upon complaint made unto her by petition, and some upon *quo warranto* in the Exchequer."

The Queen sent a message to the House, importing that the monopolies should be revoked; whereupon an address of thanks was voted; it was delivered to her Majesty by the Speaker, attended by about 180 members, on the 30th Nov. 1601. The following is an extract from her Majesty's answer. "I never put my pen to any grant but upon pretence and semblance made unto me, that it was both good and beneficial to the subjects in general, though a private profit to some of my ancient servants who had deserved well; but the contrary being found by experience, I am exceedingly beholden to such subjects as would move the same at first."—"That my grants should be grievous to my people, and oppressions to be privileged under colour of our patents, our kingly dignity shall not suffer it; and when I heard of it, I could give no rest to my thoughts till I had reformed it."

* The saltpetre patent appears to have been a public nuisance, as it gave a power of entering into any private house, cellar, stable, or other place where the nitrous matter could be gathered, and to dig or carry away without limitation; and that power appears to have been grossly abused.

1602. 44th Elizabeth. Year Books, lib. 2. p. 84. *The case of Darcy against Allien was tried before Chief Justice Popham, (Trinity term.)*

See Coke's Institutes, Part 3. c. 85.

It was on an infringement of a patent recently granted by Queen Elizabeth to Edward Darcy, groom of the chamber, for the importation and manufacture of playing cards. The patent was set aside as a monopoly, against both the common and the statute law.

Sir E. Coke says, the judgment given in this case was the principal motive of the publishing of the King's Book (1610,) as is mentioned in the preamble of the Act 21 Jas. I. and that book was a great motive of obtaining the Act to be passed.

1604. *A Proclamation by King James I. against Saltpetre-men, who, under colour of the King's Patent dug up the saline materials in private houses, unless they were well feed to abstain.*

1605. 3 Jas. I. c. 13.

An Act for bringing in a fresh stream of running Water to the North parts of London.

This was the origin of the New River Water-work. From the novelty of the undertaking, it was at that time considered as an invention. An explanatory Act was passed, 1606, 4 Jas. I. c. 12. It was to have been executed by the city of London, but they transferred their powers to

Hugh Middleton in 1608, who completed the New River, and opened it Michaelmas-day 1613, and was created a baronet. He was ruined by the expence; but the property has since been very valuable to his descendants, as well as a great advantage to the metropolis.

1605. 3 Jas. I. c. 6.

An Act to enable all his Majesty's loving subjects of England and Wales, to trade freely into the dominions of Spain, Portugal and France.

Notwithstanding a charter of incorporation, recently granted by the King, for a company to trade to Spain and Portugal, and excluding all others in England.

Rapin, in his History of England, says, the English not being well skilled in the art of dressing and dyeing their own woollen cloths, had been accustomed to send them in a white state to Holland, where they were dyed, dressed, and part sent back into England for use. The merchant adventurers had a royal charter from Queen Elizabeth, for transporting white undressed cloths, notwithstanding the statute 14 & 15 Hen. VIII. Alderman Cockaine obtained a patent from James the First, for dressing and dyeing such cloths; and the King revoked the merchant adventurers' charter, in order that all cloths might be dyed

and dressed at home; but the Dutch then prohibited the importation of dyed cloth from England, and thus shut up a great market; also the patentee did the work badly, and at a great cost; whereby the woollen trade was greatly depressed, which occasioned such clamour, that the King was obliged to permit the exportation of some white cloth, and soon after, the former state of the trade was restored.

Charles II. granted a patent for exporting white cloth; it expired in 1707; and then by 6th Anne, c. 8 and 9, the exportation of white cloth was permitted, under a small duty, to encourage the dressing and dyeing trade.

1606. 4 Jas. I. c. 9.

An Act to explain a former Act made last Sessions, 3 Jas. I. c. 6. for free trading.

Queen Elizabeth's patent (dated 17 June 1559) to merchant adventurers of Exeter, preserved.

1603. *A Patent was granted by King James I. for making Alum in England.*

Rapin says, the importation of alum from abroad was prohibited by proclamation. The manufacture had been introduced into England from abroad, without much success, till about 1600, when Sir Thomas Chaloner dis-

covered a mine in Yorkshire. The art was brought to perfection by Sir John Bouchier. The King took the whole trade into his own hands.

1610. *King James I. granted a number of Monopolies, and great complaints were made in Parliament.*1610. *A Publication in print, by King James the First, against Monopolies (mentioned in the Act 21 Jas.)*

All grants and monopolies, and of the benefit of any penal laws, or of power to dispense with the law, or to compound for the forfeiture, were declared to be contrary to the King's laws.

1621. 18 Jas. I. c. 1.
of Private Acts.

An Act containing the Censure given in Parliament against Sir Giles Mompesson, Sir Francis Mitchell, Francis Viscount Saint Albane Lord Chancellor of England, and Edward Flood.

According to Rapin, a patent had been granted by James I. to Mompesson and Mitchel, for the sole making and selling gold and silver lace, which they abused most grossly, making sophisticated lace of copper and base materials, and procuring others (who made good lace) to be fined and imprisoned for infringing their patent. Great complaints were made to Parliament; and in consequence Mitchel was imprisoned, but Mompesson escaped, and a proclamation was issued, offer-

ing a reward for his apprehension. The King informed the Parliament, that he was ignorant of the abuse of his patent, and would revoke it. The Lords confiscated the estate of Mompesson, who had escaped, and degraded him of his knighthood. Mitchel was also degraded, fined a thousand pounds, carried through the streets of London, on a horse, with his face to the tail, and imprisoned for life. The patent for gold and silver lace, and some others, were revoked by royal proclamation.

1623. 21 Jas. I. c. 3.

An Act concerning Monopolies, and dispensations with Penal Laws, and the forfeitures thereof.

This Act is chiefly declaratory of what had been before held to be law by the Judges. In the preamble, mention is made of the King's publication of 1610, but that it had not been enforced.

§ 1. All monopolies, and all grants, charters, and letters patents heretofore made, or hereafter to be made, to any person or persons whatsoever, for the sole buying, selling, making, working, or using of any thing within this realm; or of any other monopolies; or of power or toleration to do (or make warrant for doing) any thing against any law or statute; or to compound for, or grant to others, any penalty limited by any statute, before judgment thereupon had, and all proclamation or warrants any way tending thereto, are altogether contrary to the laws, and shall be utterly void. § 2. All monopolies, and all such grants, charters, letters patent, and proclamations as aforesaid, shall be tried by the common law, and not otherwise. § 3. All persons whatever are now, and shall be hereafter, disabled to use any such monopoly, grants, charters, letters patent, or proclamations as aforesaid. § 4. Any person being hereafter hindered or grieved by pretext of any monopoly, grant, charter, or letters patent as aforesaid, may sue to be relieved, by action in the courts of King's Bench, Common Pleas or Exchequer, and on judgment, shall recover against them, by whom he has been so hindered or grieved, three times the damage thereby sustained. And any person procuring any such action at law, under this statute, to be stayed or delayed, by colour of any warrant, power or authority, except of the court wherein such action shall be depending, shall incur the pain of the statute of Præmunire, 16th Ric. II. c. 5.

§ 5. Saving

This exception is the foundation of patents of invention.

This saving for saltpetre and gunpowder annulled by 16 Chas. I. c. 21.

Institutes, 3d part. c. 85.

§ 5. Saving letters patent heretofore granted, for a term of 21 years or under, for the sole working of any new manufacture within this realm, which others, at the time of making such grant, did not use. And such of the said grants as were made for more than 21 years, shall become of no force, after the expiration of 21 years from the time when they were made.

§ 6. Any declaration before mentioned, shall not extend to any letters patents and grants of privilege, for the term of fourteen years or under, hereafter to be made, of the sole working or making of any manner of new manufacture within this realm, to the true and first inventor and inventors of such manufactures, which others, at the time of making such letters patents and grants, shall not use; so as also they be not contrary to the law, nor mischievous to the state, by raising prices of commodities at home, or hurt of trade, or generally inconvenient. The said fourteen years to be accounted from the date of the first letters patents, or grant of such privilege, hereafter to be made, but that the same shall be of such force as they should be, if this Act had never been made, and of none other.

§ 7. Saving all grants, privileges or authority made or confirmed by Act of Parliament, so long as such Acts shall continue in force. § 8. Saving all warrants under Privy Seal made by his Majesty or his successors, to the Justices of the courts of law, or Justices of the peace, giving power to hear and determine offences against any penal statute. § 9. Saving the charter to the city of London, or other borough or town corporate, or to any corporations of any art, trade or mystery, or to any company of merchants erected for the maintenance of any trade.

§ 10. Saving letters patent concerning printing; digging for and making saltpetre or gunpowder; or casting or making of ordnance, or shot for ordnance. Or for any offices. § 11. Saving letters patent for digging and making allum, and for allum mines. § 12. Saving all privileges heretofore enjoyed by the hoastmen of the town of Newcastle-upon-Tyne, for selling, carrying, and shipping any pit coals out of the river Tyne: also concerning the licensing of any taverns. § 13. Saving letters patent for making of glass, granted to Admiral Sir Robert Mansel, dated 22 May, in the 21st Ja^s I.; and other letters patent granted to Ja^s Maxwell, Esq. concerning the transportation of calve skins, dated 12 June, in the 13th Ja^s I. § 14. Saving letters patent granted to Abraham Baker, concerning making smalt, dated 16 Feb. 16th Ja^s I.; also letters patent granted to Edward Lord Dudley, concerning the melting of iron ore, and making the same into cast works or bars, with sea coals or pit coals, dated 20 Feb. 19th Ja^s I.

Note:—Lord Dudley's project has in its consequences, proved of immense value to this nation. It was brought into use about 1740.

Note:—There is no provision in this, or any other Act, to oblige a patentee to enrol any description or specification of the invention for which a patent is granted to him.

Note:—Lord Coke, in his explication of the words "generally inconvenient," in § 6, of this statute assumes it to mean, that the new manufacture for which the patent is granted, must not be generally inconvenient, instead of the privilege, which is the obvious sense; he says, "There was

"a new invention found out heretofore, that bonnets and caps might be thickened in a fulling mill, by which means more might be done, than by the labours of fourscore men who got their livings by it. It was ordained, (by an Act 7 Edw. VI. c. 8.) that bonnets and caps should be thickened and fulled by the strength of men, and not in a fulling mill, for it was holden inconvenient to turn so many labouring men to idleness." If this decision had been followed, it would have set aside every patent for invention.

1623. 21 Jas. I. c. 11.

An Act to confirm a Judgment given in Chancery, for annulling certain Letters Patent granted to Henry Heron, for the sole privilege of salting, drying and packing of Fish, within the counties of Devon and Cornwall.

1625. A Patent was granted by King Charles I. for making Saltpetre and Gunpowder; and in 1629, for establishing Pawnbrokers in London.

1630. A Patent of extraordinary pretensions was granted by King Charles I. to David Ramseye, Esq.

See Rymer's Fœdera, vol. 19. p. 239.

He was a groom of the privy chamber; the patent was for 14 years, paying a yearly rent of £. 3. 6. 1. to the King. It consists of nine articles of invention, two of which deserve notice, as indicating the origin of the steam engine; viz. "To raise water from low pitted, by fire;" and "To raise water from low places, and mynes, and coal pits, by a new waie never yet in use."

Note:—The raising of water by steam, had been proposed as a philosophical principle, by Solomon de Caus, in a book he wrote in 1615, after he had been in England, in the suite of the Elector Palatine, who married the daughter of James I. Ramseye had probably some notion of carrying that principle into effect. This was many years before the Marquis of Worcester.

1631. Patents were granted by Charles I. for preserving Marsh Lands from Inundation;

Making soap of English materials; also starch.

In 1632, a patent for a diving project; and for a number of extraordinary schemes, which

are announced very much in the same enigmatical style as those which compose the Marquis of Worcester's celebrated Century of Inventions.

1634. Patents were granted by Charles I. for cleaning of Indigo;

Sedan chairs, printing a price current, soap-making, gardeners, sealing of foreign hops, weighing hay and straw, and marking butter casks, saltpetre, gunpowder, &c. In 1635, for glass-making, raisin wines, gold and silver

thread, malt and brewing. In 1637, for cards and dice, maltsters and brewers licences, butter casks, pigs and bars of iron, and licensing hackney coachmen, wine casks used by brewers, drying hops and malt with sea coal and turf.

1640. 16 Chas. I. c. 21. An Act for the free bringing in of Gunpowder, and Saltpetre, from foreign parts; and also for the free making of Gunpowder in this realm.

A free trade and manufacture allowed in gunpowder, and the materials for making the same, notwithstanding any letters patent for exclusive privileges in such trades; which patents had been saved by clause 10, in the statute of monopolies, 21 Jas. I. and renewed by Charles I.

1663. 15 Chas. II. c. 15. An Act for encouraging the manufactures of making Linnen Cloth and Tapestry.

Any persons whatsoever, natives or foreigners, may freely, and without paying any acknowledgment, exercise the trade of heckling or dressing hemp or flax; also making and whitening thread; also spinning, weaving or bleaching any kind of cloth made of hemp or flax; also making twine or nets for fishing; stoving of cordage; or making tapestry hangings; notwithstanding any law or usage to the contrary. Foreigners setting up such trades during three years in England, to have all the privileges of natural-born subjects, on taking the oaths, &c.

1663. 15 Chas. II. c. 12. An Act to enable Edward Marquis of Worcester to receive the benefit and profit of a Water-commanding Engine by him invented.

One tenth part of that benefit is appropriated for the benefit of the King's Majesty.

Note:—This has been supposed to be the steam-engine, but from the terms in which the Marquis states it, in his "exact and true definition of the engine," without making any mention of fires, it was most probably a different engine from that which he mentions as "a fire water-work," at No. 68, of his Century of Inventions.

1670. 22 & 23 Chas. II. c. 7. of private Acts. An Act for granting to Sir Philip Howard and Francis Watson, Esq. the sole use of a manufacture, art or invention, for the benefit of Shipping.

This was a proposal to sheath or cover the bottoms of ships with thin sheet lead as copper is now used; it is mentioned in the Philosophical Transactions, Vol. VIII. No. 100. p. 6192.

1674. 27 Chas. II. c. 4. of private Acts. An Act for granting a License to his Highness Prince Rupert, Duke of Cumberland, for one-and-thirty years.

Query, was not this license relative to some of the mechanical inventions for which Prince Rupert was distinguished. Solomon de Caus was employed in his father's court at Heidelburgh, when the prince was a child, and was probably his preceptor in mechanics.

1690. 2 W. & M. sess. 1. c. 16. of private Acts. An Act for the encouraging and better establishing the manufacture of white Paper in this kingdom.

Query, if this was not relative to the cylinder paper-mill, recently brought from Holland.

Orders of the House of Commons, 26 May 1685, respecting the Petition to the House of Commons, for leave to bring in a Bill to extend the terms of Letters Patent.

* See also Orders 30 June 1801, and House of Lords, 20 March 1808. By Order 13 May 1690, the Petition must truly state the case, and must be signed by the parties who are suitors for the Bill; a copy of the Patent must be annexed to the Bill. And, by another Order 24 November 1699, the Petition must set forth the suggestions and reasons.*

1690. 2 W. & M. sess. 2, c. 9. An Act for encouraging the distilling of Brandy, and Spirits, from Corn, and for laying several Duties on low Wines, or Spirits of the first extraction.

Sect. 13. All charters and letters patents already, or hereafter to be made, for the sole making of brandy, spirits, or strong waters, from corn, of any sort, or in any manner whatsoever, as a new invention, or whereby the power given by this Act (to all persons to distill brandy, spirits or strong waters, from corn) shall be in any manner restrained, shall be void.

1698. 9 & 10 W. 3, c. 43. An Act for the better encouragement of the Royal Lustring Company, Section 13.

In the 4th James II, 1688, a patent was granted for a new invention of making, dressing and lustrating silks, called Black à-la-modes, and Lustrings, for fourteen years; and, by a royal charter, 4th of W. & M., the Royal Lustring Company was incorporated; that Company have brought the said manufacture to perfection, and as the same cannot be so well carried on as by a Company, they are continued as a body corporate by this Act, as fully as if the said royal charter had been recited at large. The Act grants them the sole benefit of making, dressing, and lustrating the above silks in England, for fourteen years, from the 24th June 1698.

1699. 10 & 11 W. 3, c. 31, of private Acts. An Act for the encouragement of a new invention, by Thomas Savery, for raising Water, and occasioning motion to all sorts of Mill-work, by the impellent force of fire.

Mr. Savery had obtained a patent, dated 25th July 1698, for his invention, "which will be of great use and advantage for draining mines, serving towns with water, and for the working of all sorts of mills, where they have not the benefit of water, nor constant winds."

This was an important invention in its time, being the first steam engine which was brought to bear in real business, but it was soon superseded by Mr. Newcomen's fire engine, invented in 1710.

It does not appear that Newcomen obtained any such Act, but it has been said that he was obliged to come to an agreement with Savery, and work under his patent, and this Act.

1705. 4 Anne, c. 20.

An Act to enable the Trinity House to levy Rates on Ships, for rebuilding the Lighthouse on Edystone rocks. Explained in 1709, by 8 Anne, c. 17.

The difficulty of this undertaking and its great importance to navigation, renders it worthy of a place amongst inventions. The first lighthouse on Edystone was built of stone by Mr. Winstanley, and first used in 1698; he lost his life in it, when it was overthrown during a violent storm in 1703. Another house was built in its place, of wood,

under this Act, by Mr. Rudyerd, and finished in 1709; it was destroyed by fire in 1755.

The present lighthouse was built in stone by Mr. Smeaton, and finished in 1759. Mr. Winstanley having expended all his property in the building, left his family destitute; a pension of 100l. a year for life, was granted to his widow.

1707. 6 Anne, c. 99.

An Act for the exportation of white Woollen Cloth, before being dressed.

This exportation had been prohibited in 1522, by 14 & 15 Hen. 8, c. 3; but in 1562, Queen Elizabeth, in her sixth year, granted a patent to the Hamborough Company, with liberty to export 30,000 cloths, not wrought or dressed. Also, in 1676, Charles the Second, in his 28th year, granted a patent to Sir James Hayes, and Sir Peter Apsley, Knights, in trust for the Countess of Portland, for twenty-one years, to license the exportation of all kinds of

woollen cloths, white, or coloured, though not dressed. At the expiration of that patent in 1707, the exportation of white cloths was stopped, and in consequence this Act was passed to permit the exportation. Another Act was also passed, at the same time, 6th Anne, c. 8, to impose a duty of five shillings upon the export of every white cloth, in order to encourage the dyeing and dressing of such cloths in England.

1709. 8 Anne, c. 19.

An Act for preserving the Copy-right of printed Books to the Authors of the same.

Extended to 28 years by
54 Geo. III. c. 156.

See also 7 Geo. 2, c. 24.

For the encouragement of learned men to write useful books; the author of any book or his assigns, shall have the sole liberty of printing and reprinting such book, for fourteen years from the first publishing the same; and no other person shall print the same under a penalty. The title to the copy-right of such book must be entered before publication,

in the register book of the Company of Stationers, and nine copies of the book must be delivered to that Company, for public libraries. The price of books, if unreasonable, to be regulated by the Archbishop of Canterbury, or the Lord Chancellor, or other officers named.

1713. 12 A. stat. 2, c. 15.

An Act for providing a public Reward for such person or persons as shall discover methods of finding the Longitude at Sea. *See also 26 Geo 2; 2 Geo. 3; 3 Geo. 3; 5 Geo. 3; 10 Geo. 3; 13 Geo. 3; 14 Geo. 3.*

Methods having been already discovered which are thought true in theory, but which are difficult in practice, and require expensive experiments to bring them to bear, Commissioners are appointed to receive and examine proposals for means of discovering the longitude, and to grant money for making experiments on such plans as they judge fit; the expense not to exceed 2,000l. The first discoverer of a proper method of finding the longitude in ships at sea, if true within a degree of a great circle, shall be entitled to a reward of 10,000l., if within two-thirds of a degree, 15,000l., and if within half a degree, 20,000l. Half the reward to be paid when the majority of the Commissioners do agree that the method extends security to ships at eighty miles from shore; and the other half when a ship shall sail over the ocean, from Great Britain to the West Indies, without losing the longitude beyond the said limits. If the method shall not be found, on trial, to be of so great use as to be within the said limits, but if the Commissioners think it is of considerable use, they may order such part of the reward as they see fit.

The results of this and other subsequent Acts have been most important to the success of navigation. Mr. John Harrison was induced to set about time-keepers or watches, which he invented and made in succession, in 1726, 1736, 1739 and 1761; he was rewarded with 1,200l. in 1753, 3,800l. in 1762, 5,000l. in 1765, and 10,000l. in 1773; making the whole reward of 20,000l. Also Mr. Whiston, M. Euler, Mayer, Bird, Ramsden, Mudge, Arnold, Earnshaw, and others, have been rewarded for instruments and methods; and the Nautical Almanack and Tables have been published annually since 1766, whereby navigation has been brought to a high degree of perfection.

Note respecting the origin of enrolling Specifications of Patent Inventions.

Near the end of the reign of Queen Anne it became the custom to insert a proviso into all patents, to oblige the patentee to execute a complete specification of the invention for which the patent was granted, and also to inroll the same in the Court of Chancery, within a specified time after the date of the patent. Before that time, the patentee was not called upon for any specification; Mr. Savery's patent of 1698 has no such clause. The inconveniences of giving the patentee a privilege, without defining the object to which it extended, are obvious; nor could the public have had any security for obtaining the invention at the expiration of the patent. The authority by which this clause was introduced does not appear. It was not a Parliamentary measure. When Parliament gave a reward to Sir Thomas Lombe, in 1732, for silk machinery, a model was deposited in the Tower of London, where it still remains.

1732. 5 Geo. II. c. 8. An Act for providing a recompense to Sir Thomas Lombe, for discovering and introducing the arts of making and working three Italian engines, (one to wind raw Silk, another to spin, and another for twisting Organzine Silk,) and for preserving the invention for the benefit of the kingdom.

*Thomas Lombe, afterwards Sir Thomas, brought the invention from Sardinia into England, and had a patent for it in 1718. He established a large silk mill at Derby, but not having made profit, (chiefly because the King of Sardinia prohibited the exportation of raw silk,) Parliament granted him 14,000*l.* reward; and models of the machinery were deposited in the Tower of London. Before the introduction of this invention, all the thrown Silk used in England was bought of the Italians. The invention does not appear to have been very new or secret, for it is described, with engravings, in an Italian book, Novo Teatro di Ma-*

chine, by Vittorio Zonca, 1656; but nevertheless the real application to use, must have been a great undertaking.

The trade founded on this beginning, did not prove very extensive or very beneficial to the nation, for want of an adequate supply of raw material. The importation of foreign thrown silk had been discouraged in 1690, by 2 Wm. and Mary, sess. 1. c. 9.; and notwithstanding Sir Thomas Lombe's mills at Derby, and others, it was found necessary in 1757, to permit a more free importation of Italian organzined silk for a time, by 30 Geo. II. c. 17; and again in 1779, by 19 Geo. III. c. 9; and since by other Acts.

1739. 12 Geo. II. c. 23. An Act for providing a reward to Johanna Stephens, of Westminster, Spinster, upon a proper discovery to be made by her, for the use of the public, of the Medicines prepared by her, for removing the cause of the Stone.

£. 5,000 reward was to be paid to Mrs. Stephens for her discovery, if the Commissioners appointed by the Act should on examination be convinced of its efficacy. There is no condition of enrolling any specification; nor is it easy to find now, what the medicine was.

1741. 14 Geo. II. c. 39. An Act for surveying the principal Ports, Points, and Head Lands, on the coast of Great Britain, and for determining their Latitudes and Longitudes.

The Commissioners appointed by 12th Anne, are empowered to apply to that purpose part of the £. 2,000 placed at their disposal, for promoting means of finding the longitude at sea.

1741. 14 Geo. II. c. 41. An Act (amongst other things) allowing a drawback of the duties upon Coals used in fire engines, for draining Tin and Copper mines, in Cornwall.

Newcomen's steam engine was by this time brought into very extensive use.

1743. 16 Geo. II. c. 25. An Act for vesting in John Elwick, Esq. the sole property of an engine for making Stone Pipes, and to enlarge the term of a Patent granted for that purpose to John Tuite in 1734.

The undertaking stood still until Mr. Elwick purchased the patent right, and had at many thousand pounds expense, improved the engine beyond what it was capable of doing when first invented. The Patent was declared valid, and an additional 14 years was granted. This invention has not succeeded. It was revived under

patents in 1805 by Sir George Wright, and again in 1810, by Mr. Murdock. A Company was then established, and they made a large quantity of stone pipes for the waterworks in Manchester and some in London, but they did not answer, and were taken up.

1749. 23 Geo. II. ch. 33. An Act for securing the sole property of an Engine invented by Israel Pownoll, deceased, for raising ballast, sullage and sand, and for removing banks, shelves and shoals in rivers and harbours, to the children of the said Israel Pownoll, for 14 years, from the 1st August 1750.

I. Pownoll had a patent in 1712, and completed the engine before his death, but afterwards his children, being young, could not work it; and the patent being expired, it was not likely to be brought into use without a new grant, which was therefore made by this Act.

This engine has proved a very important invention in modern times, since it has been wrought with sufficient power by the steam engine. Most of the rivers and harbours in Britain have been greatly improved by means of such dredging engines, which are now quite common here, and many have been made to send abroad.

1750. 23 Geo. 2. c. 29. An Act to encourage the importation of Pig and Bar Iron from the Colonies in America, and to prevent the erection of any Mills for slitting or rolling of iron, or any plating forge to work with a tilt hammer, or any furnace for making steel, in any of the said Colonies.

1751. 24 Geo. II. c. 28. An Act for vesting for a time in Michael Meinzie, Esq. the sole property of a Machine by him invented for conveying of Coals from the places where they are dug, to the heaps at the mouths of the pits; and in some cases from the heaps to the staiths where they are put on board ships or keels; also a new method of drawing up coals out of the pits or shafts.

The inventor who was an advocate in Scotland, had obtained patents in 1750, for England and for Scotland; and having incurred a great expense, was not likely to be sufficiently recompensed by the term of 14 years in the patent rights. An addition of 14 years was therefore made to the term of each patent.

1753. 26 Geo. II. c. 25. An Act to render more effectual an Act (12 Anne) providing a reward for discovering methods of finding the Longitude at sea.

It is stated, that under the Acts 12 Anne and 14 Geo. II. the Commissioners had paid £. 1,200 to John Harrison, to enable him to make his watch, and also £. 500 to William Whiston for surveying the coasts of Britain; and having then only £. 250 left at their disposal, for making experiments and surveys, they are allowed £. 2,000 more for pursuing the same objects.

1758. 32 Geo. II. c. 2. An Act to enable Francis Duke of Bridgewater, to make a navigable Canal, &c. of Private Acts.

Also 33 Geo. II. c. 2. priv. and 1761. 2 Geo. III. c. 11. priv.

This deserves particular notice, as being the commencement of the series of canals, which have since proved so advantageous to the nation, and also as involving many points of new invention.

The Duke expended all his fortune before he completed the Canal in 1776, but it has been very profitable since. The works were executed under the direction of Mr. James Brindley.

1761. 2 Geo. III. c. 18. An Act for rendering more effectual the Act (12 Anne) for rewarding the discovery of the methods of finding the Longitude at sea.

The Commissioners having expended the whole of the money placed at their disposal (by 12 Anne; 14 Geo. II.; and 26 Geo. II.) a farther £. 2,000 was granted for pursuing the same objects.

1762. 2 Geo. III. c. 14. An Act for the encouragement of John Harrison, to publish and make known his invention of a machine or watch for the discovery of the Longitude at sea.

Upon disclosure of the principles of his Watch, and the method of making the same to the satisfaction of the Commissioners, they are to award him £. 5,000. to be paid so soon as the said instrument shall by future trials appear to be a proper method of finding the longitude, within the limits prescribed by the 12 Anne, c. 15. No person to be entitled to a reward under the said Act, for any timekeeper, until the merits of Harrison's watch be ascertained.

Note:—Mr. Harrison's watch had been tried in a voyage to Jamaica and back in 1762. It found the longitude very exactly. The principles of his Timekeeper were published in 1767. London, quarto.

1765. 5 Geo. III. c. 20. An Act for explaining and rendering more effectual two Acts, 12 Anne and 26 Geo. II. concerning the means of finding the Longitude at sea.

The Commissioners had advanced money to John Harrison, to enable him to make three watches, and to purchase the same of him; and on trial of one of his watches on a voyage to Jamaica, (in 1762) ordered him £. 2,500 reward. On further trial of the same watch (in 1764) in a ship from Portsmouth to Bridgetown in Barbadoes, it did not lose its longitude beyond ten geographical miles. Also lunar tables have been constructed by the late Tobias Mayer of Goettingen in Germany, on the principles of Sir Isaac Newton, and by the aid of theorems by Professor Euler of Berlin, which tables will be of use to the public for finding the longitude.

This Act directs £. 7,500 more to reward John Harrison, provided he explains his principles within six months, and gives up his three watches. The other half of the greatest reward offered by 12 Anne, to be paid to him, when timekeepers shall be made on his plan, by other persons, to determine the longitude within half a degree. It also awards a sum not exceeding £. 300 to Euler; and a sum not exceeding £. 3,000 to the widow of Tobias Mayer, for the latest manuscript of her husband's tables; and the Commissioners may give a sum not exceeding £. 5,000 to persons who shall improve the tables of the moon. Also the Commissioners are directed to undertake the construction and printing of the nautical almanack annually, and such other tables as will be useful; no other persons allowed to print or publish their tables, under a penalty.

Note. In 1767, the Commissioners gave a reward of 560l. to Mr. John Bird, for disclosing his method of dividing astronomical quadrants, which was more perfect than any before known.

1770. 10 Geo. 3. c. 34. An Act for rendering more effectual several Acts for providing a public Reward for discovering means of finding the Longitude at sea; for improving Mayer's Lunar Tables; and encouraging improvements useful to Navigation.

The sums placed at the disposal of the Commissioners, being expended in experiments, &c. a further sum not exceeding £. 5,000 was granted for the same objects.

1773. 13 Geo. III. c. 38. An Act incorporating the Company of British Cast Plate Glass Manufacturers, for the purpose of establishing one or more glass manufactories, for casting large plate glass on an improved plan; to remain in force 21 years.

This has since grown up to a great trade, but the machinery and process have been kept very secret, and are very little known. The term has been renewed from time to time by other Acts.

1773. 13 Geo. III. c. 77. An Act for granting to His Majesty a certain sum of money out of the Sinking Fund, &c.; and for paying to John Harrison, a further reward for his invention of a Time-keeper, for ascertaining the Longitude at sea; and his making discovery of the principles upon which the same was constructed.

By section 24 of this Act £. 2,000 was granted to Dr. Richard Williams, for his invention of fast green and yellow dyes for cotton yarn and thread. And by § 29, a reward not exceeding £. 8,750 was to be paid to Mr. Harrison for his invention of a Time-keeper, &c.

A description concerning such mechanism as will afford a nice and true mensuration of time, was published by Mr. Harrison in 1775. The description of his former Watch was published in 1767.

1774. 14 Geo. III. c. 66. An Act repealing all former Acts concerning means of finding the Longitude at sea, (except as to the Commissioners, and to their publishing nautical almanacks and tables); and for the encouragement and reward of persons discovering methods for finding the Longitude at sea, and useful discoveries in Navigation; and for the better making experiments relating thereto.

The first discoverer of a method which will determine the longitude to within a degree of a great circle, to have £. 5,000 reward; if to within two-thirds of a degree, £. 7,500.; and if within half a degree, £. 10,000. If it is by means of a time-keeper (the principles of which have not been made public,) the reward to be due, when two or more time-keepers of the same construction shall have been tried for twelve months at the Royal Observatory, and then in two voyages round Great Britain in contrary directions, (or such other voyages in different climates as the Commissioners shall direct) and after returning therefrom, to be tried again at the Observatory for any time, not exceeding twelve months; and when the Commissioners are satisfied that such method will determine the longitude to within the above limits, in all voyages of six months duration; and when the principles of the construction are fully explained to the satisfaction of the Commissioners and the time-keepers assigned to them.

If the method is by improved solar and lunar tables, £. 5,000 reward if they will determine the longitude to within seven minutes; that reward to be due after that exactitude has been proved, by comparison with astronomical observations, and after the property of the tables is assigned to the Commissioners.

A further sum, not exceeding £. 5,000 is placed at the disposal of the Commissioners, to pay debts incurred, for services for improving navigation; and for continuing the same course of experiments and observations.

This Act was extended by another in 1777, 17 Geo. III. c. 48. granting another sum not exceeding £. 5,000, and regulating the mode of paying lesser rewards for improvements, not worthy of the great rewards. Also in 1780, 20 Geo. III. c. 61. another sum not exceeding £. 5,000; and the same again in 1781, 21 Geo. III. c. 52. and by other subsequent Acts.

In 1777 the Commissioners gave Mr. Ramsden £. 1,000 for his machines for dividing sextants for observations at sea. Also in 1777 to Mr. Mudge, £. 500 to enable him to make his time-keeper.

1775. 15 G. III. c. 52. An Act for enlarging the terms of Letters Patent granted to William Cookworthy, chymist, for the sole use and exercise of a discovery of certain materials for making Porcelain; in order to enable Richard Champion, merchant, to whom the said letters patent have been assigned, to carry the said discovery into effectual execution for the benefit of the public.

The patent was only for England, and dated 1768; it was for using Cornish moorstone, and Grown clay, as materials to make porcelain; it was assigned in 1774, to R. Champion, who had incurred great trouble and expense, without bringing it to bear till lately, and could not receive an adequate compensation during the remainder of the term. An additional 14 years was therefore added to the privilege, without altering it in any other respect. A new specification of the mixture and proportion of the materials was to be inrolled. The Act not to hinder the use of the said materials, except in such mixture and proportions, as are so specified. A Public Act.

1775. 15 G. III. c. 61. An Act for vesting in James Watt, engineer, the sole use and property of certain Steam Engines (or Fire Engines,) of his invention, described in the said Act, throughout his Majesty's dominions, for a limited time.

This Act recites that a patent, dated 5 Jan. 9th Geo. III. (1769,) granted to James Watt, the sole benefit and advantage of making and vending certain engines by him invented, for lessening the consumption of steam and fuel in fire engines, in England, Wales, Berwick, and the Colonies; and that he inrolled the following description, 29 April 1769:

My method of lessening the consumption of steam, and consequently fuel, in fire engines, consists in the following principles; viz.
1. The steam cylinder must be kept as hot as the steam that enters it; either by a case of wood, or by surrounding it with steam, &c. &c.
—2. The steam is to be condensed in vessels distinct from the steam cylinder, and which are kept cold by the application of water, &c.
—3. Whatever elastic vapour is not condensed by that cold, is to be drawn out of the condenser by pumps, &c. —4. To employ the

expansive force of steam, to press on the pistons, and work engines, discharging that steam into the open air after it has done its office, &c.—5. To produce motions round an axis, by applying steam within hollow steam wheels, so as to turn them round, &c.—6. To apply a degree of cold not capable of condensing steam, but only of contracting it, so as to work engines by the alternate expansion and contraction of steam.—7. To use oil, wax, resin, fat or quicksilver, to render the pistons tight.

James Watt has expended great part of his fortune in making experiments to improve steam engines, but on account of the difficulties in execution, could not complete his invention before the end of 1774, when he finished some large engines, which have succeeded. In order to make those engines with accuracy, at moderate prices, a large sum must be previously expended in mills and apparatus; and as several years, and repeated proofs will be required before the public can be fully convinced of their interest to adopt the invention, the term of the patent may elapse before he is recompensed. By furnishing mechanical power at less expense, and in more convenient forms than hitherto, his engines may be of great utility in many great works and manufactures, yet he cannot carry his invention into that complete execution that will

render

render it of the highest utility of which it is capable, unless the term be prolonged, and his property in the invention secured in Scotland, as well as in England and the Colonies.

To enable and encourage him to prosecute and complete his said invention, so that the public may reap all the advantages therefrom in their fullest extent, the Act vests the sole advantage of making and selling the engines therein described (as above), within Great Britain and the Colonies, in James Watt, his executors, administrators and assigns, during 25 years from the passing of the Act. The Act not to hinder any persons making any contrivance relating to fire engines, which are not at present of the invention of James Watt, or which are not particularly specified in the Act (as above.) Every objection in law competent against the patent, shall be competent against the Act, except as to the term. The privilege of the sole benefit of the invention not to be assigned or vested in trust to more than five persons, nor divided into more than five shares, or used in any other way contrary to the 6th Geo. I. A Public Act.

Note:—The real title of Mr. Watt's patent was for his method of lessening the consumption of steam and fuel in fire engines. The patent was in force more than 30 years; viz. from the beginning of 1769, to the middle of 1800. Mr. Watt had no patents for Scotland or Ireland, but the Act extends the privilege of the patent for England and the Colonies, to Great Britain and Colonies. There is no clause in the Act to oblige Mr. Watt to describe what he had done since his specification of 1769, although the difficulties which he had overcome between that and 1774, is one of the reasons for the Act; nor to specify what he might do afterwards, although the Act was passed for his encouragement to complete his invention. It would have been a great advantage to the public, if he had been obliged to make a complete specification, to be substituted for the first enumeration of principles; all the litigation in Boulton and Watt against Bull, in 1795, and against Hornblower in 1799, would have been avoided, as all the arguments turned upon the want of a specific description of Mr. Watt's engine. In the Acts for the prolongation of Hartley's and Turner's Patents, the clause relative to the legal objections to the patent, is not general as above, but only mentions objections as to the novelty of the invention; there is no clause for a new specification.

Mr. Watt's invention, and the perfection he gave to it, during the operation of this Act, has proved of more value to the nation than can be calculated; probably as much as the inventions of Lord Dudley for smelting iron by pit coal, in 1619, or as those of Hargrave, Arkwright and Crompton for spinning machinery, about the same date as

Mr. Watt. Dudley and Hargrave were not encouraged, but were persecuted, and their works destroyed by mobs; after Dudley's death, his process laid dormant during a century, probably for want of support to him. These great inventions have had a close connection, and each one has promoted the progress of the other very greatly.

1776, 16 Geo. III. c. 29. An Act for vesting in John Liardet, clerk, the sole use and property of a certain composition or cement of his invention, throughout Great Britain and the Colonies, for a limited time.

Liardet's patent was dated 1773, for England and the Colonies. The cement or stucco must be applied to buildings as soon as it is made, and could not be sent to a distance; therefore it could come into use only slowly, so as not to recompence the inventor. The term of the patent was extended 18 years from the passing of the Act, and the patent right extended to Great Britain and the Colonies. The patentee not to be allowed to take more than a specified price for the cement or stucco on buildings. The Act not to hinder the use of any other cement or stucco than that at present invented by Liardet, and described in his specification. Every objection to the cement's not being a new invention, sufficient to invalidate the patent, to be a bar to any action brought under this Act. The privilege not to be transferred to more than five persons. A new specification of the invention, in its present improved state, to be inrolled. A Public Act.

This stucco for the walls of buildings, was called Adam's Oil Cement, because Mr. Adam, the architect, became interested in the patent. In 1778, it was set aside for insufficiency of the specification, on a trial, Liardet v. Johnson.

1777, 17 Geo. III. c. 6. An Act for vesting in David Hartley, Esq. the sole use and property of a method by him invented, of securing buildings against the calamities of fire, throughout his Majesty's dominions, for a limited time.

Mr. Hartley had a patent for England and the Colonies, in 1773, for his method of applying iron plates to cover the wood-work of buildings and ships, so as to prevent the access of fire; and having expended large sums in experiments to perfect the invention, and still more money being requisite, without a prospect of recompence during the term of the patent, the term was prolonged 31 years from the passing of the Act, and the patent right extended to Great Britain and the Colo-

nies, except as to ships. The invention might be applied in any buildings, used in fitting out or victualling the King's ships of war, without licence from the patentee. The privilege not to be transferred to more than five persons. Any objection to the invention not being new, sufficient to invalidate the patent, to be a bar to any action brought under this Act. The patentee not to be allowed to take more than a specified price for the iron fire plates. A Public Act.

Note:—Two thousand five hundred pounds was granted by Parliament to Mr. Hartley, to enable him to ascertain the practicability and utility of his method.

This invention was mentioned by Chief Justice Eyre, during the trial Boulton and Watt v. Bull, in 1795, as an instance of a patent for a method; "The invention is no substance or composition of things, it is a mere negative quality, the absence of fire, which effect is produced by a new method of

" disposing iron plates in buildings; he did
" not invent iron plates, but only the method
" of disposing them to produce the effect.
" His patent could not be for the effect pro-
" duced, because that is merely negative,
" though meritorious."

1782. 22 Geo. III. c. 45. In an Act for restraining any person concerned in any Contract, Commission, or Agreement made for the public service, from being elected, or sitting and voting as a Member of the House of Commons.

Section 8. If any person actually possessed of a patent for a new invention, or a prolongation thereof by Act of Parliament, and having contracted with Government concerning the object of the said patent, before the passing of this Act, shall give notice of his intention to dissolve the said contract, the same shall be null and void from the time of giving such notice.

1785. 25 Geo. III. c. 38. An Act for vesting in Edward Bancroft, Doctor in Physic, the sole property of his invention or discovery of the use and application of certain Vegetables for dyeing, staining, printing and painting certain valuable colours, throughout England, Wales, and Berwick, for a limited time.

Dr. Bancroft had a patent in 1775, for the use of certain vegetables growing spontaneously in America, for dyeing, &c.; but having been deprived of the benefit thereof, by the American war, the term was extended fourteen years from the passing of the Act; which is not to hinder the use of any invention except that for which the patent was granted; and every objection to the invention not being new, sufficient to invalidate the patent, to be bar to any action brought under this Act. The privilege not to be assigned to more than five persons. A new specification of the invention in its present improved state to be inrolled. A Public Act.

1792. 32 Geo. III. c. 72. An Act for vesting in James Turner the sole use and property of a certain Yellow Colour, of his invention, throughout England, Wales, and Berwick, for a limited time.

Turner had a patent, in 1781, for his yellow colour, which is composed of British materials, and is better and cheaper for painting coaches and other works than that formerly imported, which was poisonous; his colour is now largely exported. Owing to secret piracies in 1787 to 1789, his sale was almost taken from him; he brought one action to trial, and obtained two verdicts therein (a new trial having been granted,) also an injunction, but he only obtained nominal damages, and has not been rewarded for his invention. The Act extends the term of the patent, for eleven years, from the 24th of June 1792. Turner not to sell the colour at more than five guineas per hundred weight; the Act not to hinder any person from making any yellow colour which was publicly used before the date of the patent, but only such as is of Turner's invention, and as is described in his specification. Every objection which might have been made to the said yellow colour not being a new invention, within the meaning of the Act 21 James 1, sufficient to invalidate letters patent, may be bar to any action brought by virtue of this Act. The privilege not to be assigned to more than five persons. A Public Act.

Note:—This Clause (which is in the same words as in other preceding Acts, excepting that of Mr. Watt,) appears not to allow any of the objections which might be made to the form of the specification; which objections were so strong, that a verdict had been given against the patentee, in 1787; *Turner v. Winter*. There is no Clause calling for a new specification.

1792. 32 Geo. III. c. 73. An Act for more effectually securing to Joseph Booth, and to the public, the benefit of an invention of a machine or apparatus, and certain chemical compositions, for making various kinds of Woollen Cloth; for which he has obtained Patents, (but has not yet inrolled specifications thereto.)

A patent for England in 1792, also a patent for Scotland; containing the usual condition of his inrolling a specification within four months after their respective dates. In order to prevent the invention getting to Foreign countries, this Act allows him (instead of inrolling within four months,) to deliver his specification, within eight months, to the Lord Chancellor, who shall appoint two persons to examine the process therein described; such persons making oath not to divulge the process, to which they shall attend, in order to complete and perfect the said specification; and they shall answer all questions which shall be at any time afterwards demanded of them by the Lord Chancellor respecting the same; and shall return the specification altered and amended, if need be, to the Lord Chancellor, with an affidavit by them, and by Joseph Booth, that the specification fully and accurately defines and describes the whole invention and discovery, and the method of using the same. The specification and affidavits shall be enclosed in a cover, under seal of the Lord Chancellor, and shall be lodged in the office of one of the Masters, to be by him appointed. § 2. The packet shall not be removed from the custody of the Master, on any pretence, except by order of the Lord Chancellor, who may open the same, if required, on account of application being made for patents for inventions of a similar nature, or on account of any trial at law; and after such use the packet shall be sealed again, and deposited with the Master, to remain there, until the end of the fourteen years term of the patent, and then the specification shall be inrolled, as directed by the patent. § 3. The above shall be held as a performance of the provisos of the patents for England and for Scotland. And also (§ 4) of the proviso of a further patent intended to be granted for the colonies, and for which His Majesty has signed a warrant.

Mr. Booth intended to operate by machinery upon a tissue or web of carded wool, so as to interlace or entangle, and felt the fibres together, and thus form cloth, or rather felt, without the previous operations of spinning and weaving.

Mr. Booth's invention was tried on a large scale at Taunton, also near Salisbury, and again at Merton, near London, but without any success; the felt not having any of the strength and durability of woollen cloth.

In 1792 - *Mr. Jonathan Hornblower made application to Parliament for an Act to prolong the term of his patent of 1781, for a Fire or Steam Engine for raising water.*

The bill was withdrawn in consequence of the opposition made by Messrs. Boulton and Watt, on the ground that Mr. Hornblower's engine was a plagiarism of Mr. Watt's invention, for which he had a patent in 1769, and an Act for extension in 1775.

In 1793 - *A Committee of the House of Commons was appointed to enquire into, and ascertain the merits of certain Marine Time-Keepers, invented and made by Mr. Thomas Mudge, in 1774 and 1777.*

In consequence of the recommendation of the Committee, a reward of £. 2,500 was given to Mr. Mudge, in addition to the £. 500 which had been paid to him, in 1777, by the Board of Longitude. During this enquiry, the Committee found that two chronometers made by Mr. Arnold had performed better than those of Mr. Mudge. A description of Mr. Mudge's time-keeper was published in 1792.

Note:—In 1794, Mr. Arnold had a reward of £. 1,322 for those chronometers; and in 1805, his son received a further reward of £. 1,678 for them, making in all £. 3,000 to Mr. Arnold. Mr. Earnshaw, another successful maker of chronometers, received £. 500 in 1799, and £. 2,500 more in 1805, making £. 3,000.

1794. 34 Geo. III. c. 63. *An Act, allowing the exercise of an invention of a new method of tanning Hides and Skins. Confirmed and extended by another Act, 35 Geo. III. c. 97.*

Samuel Ashton had a patent in 1794, and duly enrolled, a specification of the method, and of the ingredients to be used in the tan-liquor; but doubts having arisen, whether such method be within the provisions or restrictions of certain Acts of Parliament, and consequently, whether the patent be valid. This Act declares, that nothing in any previous Act shall be construed to prevent S. Ashton, or others, by his licence, during the term of his patent, or any persons whatsoever, after the expiration of that term, from tanning hides and skins in the manner, and with the materials described in his specification, nor from selling hides and skins so tanned. The Act not to be construed to give any greater validity to the patent, than it would have had if no such Acts had been in force at the date of the patent. A Public Act.

1795. 35 Geo. III. c. 68. *An Act for vesting in the Right honourable Henry Seymour Conway, the sole property of a kiln or oven, by him invented, for burning Lime, and for the use of distillers and brewers.*

He had a patent for England in 1782, and also a patent for Scotland in 1786. His plan was to make a kiln for burning lime, and with the same fire to serve at the same time for giving heat to a still or boiler placed over it, and in such manner, that the coals used would be converted into coke. In consideration of the great expense the patentee had incurred, without getting the plan into use; § 1. The term of the privilege is prolonged, during 20 years, from the 1st January 1796, within Great Britain. § 2. The Act not to hinder the making of any kiln by any method not then invented by him, and as specified in the Act; and every objection in law competent against the patents, to be competent against the Act, except as to the term. § 3. The privilege not to be transferred to more than five persons. § 4. A Public Act.

In 1798 - *Mr. Joseph Bramah made application to Parliament for an Act to extend the term of his patent of 1784, for locks for doors, &c.; but the bill was withdrawn, in consequence of opposition, after some evidence had been taken before a Committee.*

1801. 30 June - *An Order of the House of Commons, respecting notice of application to Parliament, for any Act to prolong the term of any letters patent.*

The notice which is to be inserted in the London Gazette, must have prefixed to it in capital letters, the name by which the invention is usually distinguished; and it must contain a distinct description of the invention, with a statement of the term of the duration of the patent.

1801. 41 Geo. III. c. 125. *An Act for enabling Matthias Koops to assign the benefit of an invention for making paper from straw, and other substances, to a greater number of persons than is limited by his patents for the invention.*

The patents for England and for Scotland, granted in 1801, contained the usual proviso, that the privilege should not be transferred or assigned to more than five persons, nor used in any way contrary to the 6 Geo. I. As it was necessary to erect expensive buildings, and a steam engine, to carry on the new manufacture of paper, it was therefore thought expedient to enlarge that proviso. The Act allows the patent rights to be transferred or assigned to any number of persons not exceeding sixty. A Public Act.

This Act was cited during the trial of Hesse v. Stevenson, in 1803, respecting the property in Koops' patent rights, which he assigned to certain directors, and they had sold shares under this Act to a number of persons, and had established a large manufactory; but as the method failed totally, some of the shareholders endeavoured to get back the purchase money that they had paid to the directors, on the ground that Koops had been a bankrupt some years before, and had not obtained a certificate at the date of his patents, therefore he had no power to assign to the said directors, and could not empower them to sell shares. It was held, that this Act did not give Koops any better title to the patent rights than he had before, and that they belonged to his assignees of bankruptcy, consequently that the sales having been made without their concurrence, were void.

1801. 41 Geo. III. c. 133.
of local and personal
Acts.

An Act for vesting, for a limited time, in Edmund Cartwright, clerk, the sole property in certain machinery by him invented for Wool-combing preparatory to spinning; for which patents have been granted to him; viz.

A patent, for England, in 1790, for dressing, heckling, combing and preparing hemp, flax, wool, hair, silk and cotton; also another, in 1790, for improvements on and additions thereto; and a corresponding patent for Scotland. Also another patent for England, in 1792, for improvements upon, and additions to his machinery aforesaid, for manufacturing wool, hemp, flax, &c. from the raw state, till made into yarn, twist, ropes and cables, and till perfected in the loom and cut for raising a pole. Specifications were duly enrolled. The patent rights being infringed, he commenced a suit at law, at great trouble and expence, whereby, and also by the expenses of bringing the inventions for woolcombing to perfection, he has become involved in debt, which he cannot repay, nor receive a recompense without a prolongation of the terms of the said patents, so far as relates to woolcombing.

§ 1. This Act vests in E. Cartwright, the sole right to all his machines and inventions contained in the said patents and specifications, which relate to the business of woolcombing, for fourteen years from the passing of the Act. § 2. Mr. Cartwright to enrol a new specification of his said inventions for woolcombing, without being obliged to use the same words and figures as in the former specification, but may use such words and such figures as are most proper for describing the invention in its improved state; and if he shall describe any better practical applications of the principle of the invention than have been generally practised, so as not to vary from such principles, it shall not weaken the claim of the said Edmund Cartwright to be considered as the inventor of such principles, notwithstanding that such explanation may vary from the former specifications. § 3. The Act not to hinder the use of woolcombing machinery, not then the invention of Edmund Cartwright, as described in his specifications, and the new one to be enrolled. § 4. The privilege not to be transferred to more than five persons. § 5. All claims and liens of Mr. Cartwright's creditors, and others on the property in his said patents, shall remain in force as long as the Act, or until the same be discharged. § 6. A Patent to William Toplis, in 1793, for machinery for combing and preparing wool for spinning, shall not be affected by the Act. § 7. All agreements and licences for the use of the patents (the conditions of which have been fulfilled) to be continued in force as long as the Act. § 8. All objections in law against the patents to be competent against the Act, except as to the term. § 9. A Public Act.

In 1809, Mr. Cartwright received a reward of £. 10,000 from Parliament for his inventions.

1807. 47 Geo. III. s. 2.
c. 131. of local and
personal Acts.

An Act for prolonging the terms of certain patents assigned to Henry Fourdrinier, and Sealy Fourdrinier, for the invention of making Paper by means of machinery.

The patents were granted to John Gamble, in 1801; and for improvements, in 1803; also corresponding patents for Scotland and for Ireland, in all six patents; to which specifications were duly enrolled. In 1804, they were assigned by J. Gamble to H. and S. Fourdrinier, who had established such machines in actual use, and also workshops for making the machines; but at such great expenses, as could not be repaid without an extension of the terms of the patents.

§ 1. The Act vests the sole right of the improved machines in H. and S. Fourdrinier and J. Gamble, for 15 years from the passing of the Act. § 2. A scale of prices, fixed by the Act, for licences to use the patent machines, until there shall be a certain extent of such machinery in use; and then a reduction of price to take place according to another scale on all existing licences, and all future licences. § 3. No more than the scale of prices to be henceforth paid by those who had previously contracted for licences on higher terms; and all such licences to continue in force as long as the Act. § 4. The Act not to hinder the using any invention different from those described in J. Gamble's specifications, and in the new ones, to be enrolled, viz. § 5. One of the parties, to enrol in England, Scotland and Ireland, new specifications of the invention and machine in its most improved state, within six months after the passing of the Act, but not to be obliged to use therein the same words or delineations as in the former specifications; having liberty to use only such words and delineations as should be proper for describing the invention in its most improved state, and in what manner the machine was to be made and used, and how the work was to be done thereby; also that they should therein explain such better practical application of the original and improved principle of the machine, and all the improvements thereof, as they then used and practised. § 6. Every objection to the validity of the patents, and to the sufficiency of the specifications enrolled as aforesaid, to be of the same force as if the Act had not been passed, and as if the specifications required by the Act had been enrolled in due time, instead of the former ones respectively, except as to the term. § 7. The privilege not to be assigned to more than five persons. § 8. A Public Act.

Observations:—The original invention of the paper machinery was made in France, and communicated to Mr. Gamble, who took out the patents in this country, but the invention was very greatly improved by Mr. Donkin, whom the patentees employed to bring the invention to bear, and execute the patent machinery. Messrs. Fourdrinier became bankrupt in 1810, owing to the great expenses they incurred; but afterwards the machines were made very complete in the hands of their assignees, and have been brought into general use, with great advantage to the public. In 1817, the assignees were obliged to proceed in Chancery against several

infringers, who submitted without coming to a trial. In 1819, an action *Bloxam v. Elliot* was tried in the Court of King's Bench, and the assignees gained a verdict. In 1825, another action, *Bloxam v. Elsee* was tried in the Court of King's Bench, and a verdict given for the assignees; but in 1827, the court directed a new trial, which the assignees would not pursue, on account of the great expenses they had incurred in the previous trials; and the opinion of the court, when the new trial was ordered, being decidedly against the validity of the patents, they were in effect set aside.

1808, 23 March.

A Standing Order of The House of Lords, respecting Bills for extending the terms of Letters Patent.

That no Bill, for the purpose aforesaid, shall be read a third time in this House, unless it shall appear that the letters patent, of which it is intended to extend the term by such Bill, will expire within two years from the commencement of the Session of Parliament in which the application for such Bill shall be made, and unless it shall appear that the application to Parliament for extending the term of the letters patent is made by the person, or by the representatives of the person, who himself originally discovered the invention for which such letters patent were granted by His Majesty; and that the knowledge of such invention was not acquired by such person as aforesaid, by purchase or otherwise, from the inventor or owner of the same, or by information that such invention was known and pursued in any foreign country.

Note:—*Mr. Crosley's application to Parliament in this present Session (1829) was withdrawn, in consequence of this Order. But Mr. Langton's, which was also within the terms of its prohibition, was passed into an Act.*

1810, 50 Geo. III. c. 163.

An Act for granting certain powers to a Company to be incorporated by charter, to be called "The Gas Light and Coke Company," for making inflammable air for the lighting of the streets of the Metropolis, and for procuring coke, oil, tar, pitch, asphaltum, ammoniacal liquor and essential oil, from coals.

Note:—*This was the first legislative encouragement to the public adoption of the then new invention of illuminating towns by gas, which has since been brought into general use in Britain, with great advantage.*

1813, 53 Geo. III. c. 157.

An Act for granting the sum of £. 50,000. to John Palmer, Esquire, in consideration of the public services performed by him; videlicet,

In the accommodation afforded to the public, and the benefit derived to the revenue, from the adoption of his plan for the conveyance of the mails. This is not to affect his annual pension of £. 3,000. out of the revenues of the Post Office, ordered in 1793.

1813, 53 Geo. III. c. 179.

of local and personal
Acts.

An Act for securing to James Lee and the Public, the benefit of his invention, of certain new methods of preparing Hemp and Flax, by enabling him to lodge the specification under certain restrictions.

Mr. Lee had patents for his invention in 1812, in England, Scotland and Ireland, with provisos, that specifications should be enrolled within fifteen months of their dates respectively; but as foreign agents might obtain copies thereof, if so enrolled, and send them abroad, so as to enable foreigners to use the invention, before the King's subjects could by law use the same; § 1. The patentee was required by the Act, instead of enrolling his specifications, to deliver the same to the Lord Chancellor within fifteen months from the date of the first patent, with an affidavit by the patentee, that the whole of the invention and the method of using the same was therein described. The specification and affidavit shall be enclosed in a cover, under the seal of the Lord Chancellor, and lodged in the office of one of the Masters of Chancery, to be nominated by the Lord Chancellor; which master is to preserve the same. § 2. The said packet not to be removed from the custody of the said master on any pretence, except by order of the Lord Chancellor, who may call for and open the same whenever it may be necessary, on account of applications for patents for inventions of a similar nature, or on account of any trial at law; and after such use being made, the packet shall be sealed up again and deposited with a master as before. § 3. Two copies of the said specification, with affidavits by the patentee that they are true copies, to be delivered under cover sealed by the patentee, one to the Lord Chancellor for Ireland (who shall deposit the same in the custody of one of the masters in Chancery in Ireland,) and the other to the Lord Chief Baron of the Exchequer in Scotland, (who shall deposit the same in the custody of the King's Remembrancer in the Exchequer in Scotland.) § 4. And the said packets so deposited shall be kept as before directed for the original, and may be opened and examined, when necessary, by the Lord Chancellor in Ireland, or Lord Chief Baron in Scotland, and then sealed up again and deposited as before. § 5. The several packets so deposited shall be kept as aforesaid until the expiration of seven years from the passing of the Act, and shall then be enrolled by the persons having custody of the same, and by the said patentee or his executors, administrators or assigns in the Courts of Chancery in England, Scotland and Ireland as directed by the patents respectively. § 6. The delivery of the said specifications, and the enrolment thereof within four months after the expiration of the said term of seven years, as before directed, shall be deemed as effectual a fulfilment of the provisos in each of the patents as if they had been enrolled within the time stated therein. § 7. A docquet or abstract of the said several letters patent, containing the date, and the words in which the invention is therein described, shall, within four months from the passing of this Act, be enrolled in place of the specifications. § 8. In case a specification of the invention shall not be duly enrolled, in pursuance of each patent, within four months after the said term of seven years from the passing of the Act, the patent shall become void. § 9. A Public Act.

Note:—*Mr. Lee's invention was tried on a large scale, but did not prove successful; it was intended to prepare flax for spinning, without previous dew rotting or water rotting. The manufactory was destroyed by fire, and has not been renewed.*

1819, 59 Geo. 3. c. 5.
Port and Harbour
Charges.

An Act to ascertain the Tonnage of Vessels propelled by Steam Power.

In taking the length of the vessel in order to calculate the tonnage, (according to a rule which is prescribed in the Act,) the length of the engine room is to be deducted. No goods to be stowed in the said engine-room, except fuel for the voyage; and if any goods are so stowed, the vessel shall not be measured according to this Act, but after the usual manner.

This Act has been a considerable encouragement to steam navigation, as it reduced all the port and harbour charges upon steam vessels, much below what they were before.

About 1819 - - - - - *A Bill was brought into the House of Commons, to conceal the specifications of all inventions for which patents are granted, from public inspection, in order that the inventions might not be sent abroad. It was thrown out.*

Note:—It was stated by the Lord Chancellor Eldon, in the case of Koops ex parte in Chancery in 1802, that a clause to the same effect had been inserted in a Bill before Parliament in 1801, on the motion of Lord Thurlow, seconded by Lord Rosslyn; but it was universally rejected, and he, Lord Eldon, thought on very proper grounds.

In 1822 - - - - - *A Petition was presented to the House of Commons, praying for some amendments in the law relative to patents for inventions; and a Bill was brought into the House for that purpose.*

One of its principal provisions was to give security to the inventor, from the time of his first application for a patent, during a certain time allowed for making experiments before the date of the patent. Also to permit an invention to be assigned, and the patent to be afterwards granted to the assignee. It was thrown out on the second reading.

In 1825 - - - - - *A machine was ordered to be made at public expense, under the direction of Charles Babbage, Esq. and according to his invention, for calculating and printing Mathematical Tables of series of numbers.*

1826, 23 March. *An Order was made by the House of Commons, for Returns of the Expenses incurred at different Public Offices in taking out Patents (in England, Scotland, and Ireland) independent of the Specification; distinguishing the items or heads of that expense; also the lowest and highest expense of the Specification.*

1. *Return from the Office of the Secretary of State for the Home Department, England:*

Reference to the Attorney or Solicitor General	-	-	-	-	£. 2	2	6
Royal Warrant	-	-	-	-	7	13	6

With an addition of £. 1. 7. 6. if the patent of invention extends to His Majesty's colonies and plantations abroad; and if the patent is granted to more than one person, an additional fee upon the Royal Warrant of £. 1. 7. 6. for each additional person.

King's Bill	-	-	-	-	7	13	6
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With an addition of £. 1. 7. 6. if the patent extends to the colonies; and if granted to more than one person, an additional fee upon the King's Bill of £. 1. 7. 6. for each additional person.

-2. *From the Office of the Secretary of State for the Home Department, Scotland:*

Reference to the Lord Advocate	-	-	-	-	£. 2	2	6
Royal Warrant and Stamp	-	-	-	-	16	17	-

And if granted to more than one person, an additional fee of £. 2. 15. 0. for each additional person.

3. *From the Office of the Secretary of State for the Home Department, Ireland:*

Reference to the Lord Lieutenant	-	-	-	-	£. 2	2	6
Warrant and Stamp	-	-	-	-	9	3	6

And if granted to more than one person, an additional fee of £. 1. 7. 6. for each additional person.

Whitehall, 6 April 1826.

Signed by Geo. R. Dawson.

4. *Return from the Attorney or Solicitor General's Offices of the expenses incurred there for taking out a Patent for England:*

To the Attorney General for his Report	-	-	-	-	£. 3	3	-
To the Clerk	-	-	-	-	1	1	-
If a Caveat be entered, the Clerk receives	-	-	-	-	-	5	-
To the Attorney General, for his approving, settling, and signing the Bill	-	-	-	-	5	-	-

If the Patent is opposed (which sometimes happens) the following Fees are charged:

To the Clerk for every Summons, summoning the parties to attend before the Attorney General	-	-	-	-	-	5	-
To the Attorney General, for the hearing of the parties, by themselves, or their agents and witnesses; each party	-	-	-	-	2	12	6
To the Clerk	-	-	-	-	-	12	6

The same Fees are paid, whether the patent passes the office of the Attorney or the Solicitor General.

10 April 1826.

Signed by H. Haines and H. Owens,

Clerks to the Attorney and Solicitor General.

5. Return from the Patent Office of the Attorney General, of the expenses incurred there for taking out a Patent for England:

Stamp Duty on the Warrant from the King to prepare a Bill for his Majesty's signature to pass the Great Seal	-	-	-	-	£.1	10	-
To the Clerk of the Patents for preparing the Bill and Docquet, and his fee	-	-	-	-	5	10	6
Stamp Duty on the Bill	-	-	-	-	1	10	-
Ingrossing Clerk	-	-	-	-	1	1	-
To the Clerk of the Patents, for preparing and ingrossing two Transcripts of the Bill to be passed through the Signet and Privy Seal Offices, parchment for such Transcripts, and transmitting the same to those offices; each Transcript 13s. 9d.	-	-	-	-	1	7	6
Stamp Duty on each Transcript, £. 1. 10.	-	-	-	-	3	-	-

10 April 1826.

Signed by M. Poole, Clerk in the Patent Office.

6. Return from the Signet Office of the Fees payable there for a common Patent for an Invention, for England; and also for Ireland:

For England - - - £.4. 7. 0.	For Ireland - - - £.3. 3. 0.
Signet Office, } 10 April 1826. }	(signed) Tho' Venables, Deputy Clerk of the Signet attending.

7. Return from the Privy Seal Office, of the ordinary expenses payable there, for a grant of a Patent for an Invention passing the Privy Seal for England:

Office Fees	-	-	-	-	-	-	-	£.4	-	-
Stamps	-	-	-	-	-	-	-	-	2	-
								£.4	2	-

Privy Seal Office, }
April 1826.

John Thomas Fane,
Clerk of the Privy Seal in attendance.

8. Return from the Lord Chancellor's Patent Office, of the Fees payable there on a Patent for an Invention for England, passing under the Great Seal:

Patent Office	-	-	-	-	-	-	-	-	-	£.5	17	8
Stamps	-	-	-	-	-	-	-	-	-	30	2	-
Boxes	-	-	-	-	-	-	-	-	-	-	9	6
Deputy	-	-	-	-	-	-	-	-	-	2	2	-
Hanaper	-	-	-	-	-	-	-	-	-	7	13	6
Deputy	-	-	-	-	-	-	-	-	-	-	10	6
Recepi	-	-	-	-	-	-	-	-	-	1	11	6
Sealers	-	-	-	-	-	-	-	-	-	-	10	6
										£.48	17	2

Every additional name pays an additional fee to the Hanaper of £. 2. 13. 6.

Patent Office, Adelphi, }
17 April 1826.

(signed) James Seton,
D. C. Patents.

In 1829 - - - - - A Petition was presented to the House of Commons, stating the defects of the present law relative to Patents for Inventions, and praying a revision and amendment thereof; printed in the Journals of the House.

In 1829 - - - - - Mr. Samuel Crosley applied to Parliament to extend the terms of a patent for an improved Gas Apparatus assigned to him, but granted in 1815 to Mr. Samuel Clegg, the inventor. The Bill was withdrawn after the second reading, because it was found that the Standing Order of the House of Lords, in 1808, would have prevented the Bill being read in that House; the prolongation not being for the benefit of the original inventor.

1829. 10 G. IV. c. 135. An Act for vesting and securing to John Stephen Langton, Esq. his executors, administrators and assigns, certain Profits and Emoluments, for a limited time.
Of local and personal Acts.

This Act is for extending the term of John Stephen Langton's patent of 1825, for his improved method of seasoning timber and other wood.

The patent having 10 years of its term unexpired, the passing of the Bill through the House of Lords, was contrary to their Standing Order of 1808.

The preamble of the Act recites the description of Langton's improved method of seasoning timber and other wood; and states, that whereas the said invention will be of vast importance to the public service, and of general utility, provided timber so seasoned shall prove as sound and durable as wood seasoned after the usual manner; but the ascertainment of that fact, (particularly for the purposes of ship-building) will require a very great outlay of capital, and a long period of time must elapse, before such proof can be established. In order therefore to encourage

encourage the said John Stephen Langton, his executors, administrators and assigns, to establish his invention, and in order that he may be recompensed for the same, and that the use thereof may be immediately laid open on fair and equitable terms, it is enacted, That such profits as are after stated in the Act, are granted to the said John Stephen Langton, his executors, administrators and assigns, for the term of 21 years from the passing of this Act, from all persons throughout His Majesty's dominions, except Ireland, who shall directly or indirectly use his said method of seasoning timber, or shall counterfeit the same. The Act grants liberty to all persons to use the said method, on giving seven days notice thereof to John Stephen Langton, his executors, administrators or assigns; such persons using the method, to pay to John Stephen Langton, monthly, during 21 years, at the rate of sixpence on every twenty shillings gross value of all timber and wood so seasoned by them during each preceding month.

The vessels used for containing timber to be seasoned according to the said method, to be closed under the lock and key of John Stephen Langton. The said John Stephen Langton to attend to see timber or wood put in and taken out of such vessels at times specified by the Act, and to be paid for such attendance at the rate of two shillings for every visit not exceeding an hour; and to pay a penalty of five pounds for every default of attendance, to the person injured thereby; the said John Stephen Langton to have access to the premises of persons using his method, at all seasonable times. This Act not to extend to any method of seasoning timber publicly used in Great Britain before 1826, or to any other than that method which is described in the Act; nor to any timber seasoned in His Majesty's dock yards, or by the Board of Ordnance. The Act to become void if 500 tons of shipping, wholly or chiefly built of timber seasoned by the recited method, have not been launched within three years from the passing of this Act.

The said Stephen Langton is empowered to recover the sums provided to be paid to him by this Act, whenever the payment thereof is neglected for seven days after he has made lawful demand, by distress and sale of the goods and chattels of the persons neglecting so to pay him, under warrant of two or more Justices of the peace; and if such persons refuse to pay the sums due, the said John Stephen Langton is empowered to stop their practice of his said method until payment shall be made. Appeals may be made from the decisions of the Justices of the peace to either of the courts of Record at Westminster; and in case it shall be proved there that John Stephen Langton is not the first and true inventor of the "combination of the apparatus or machinery, &c. for seasoning wood, and proving when the same is seasoned, as such combination is described in the preamble of the Act," then the proceedings to be quashed, or John Stephen Langton, his executors, administrators or assigns, to be nonsuited. All deeds of agreement between John Stephen Langton and other persons, relating to the benefits secured by this Act to him, his executors, administrators and assigns, to be inrolled in the Court of Chancery of England or Scotland respectively. A Public Act.

Dr. Colquhoun in his Treatise on the Wealth, Power, and Resources, of the British Empire, Quarto 1815, makes the following account of Parliamentary Rewards given for useful Discoveries previous to 1788. Note, they are all in addition to those Grants for which express Acts of Parliament have been passed, as enumerated in the preceding Lists:

To Dr. Irvine, for his method of making sea water fresh and wholesome	£. 5,000
To David Hartley, to enable him to ascertain the practicability and utility of his method of securing buildings and ships from fire	2,500
To various persons for discovering Dyes useful in manufactures	5,500
To Charles Dingley, for erecting a public windmill for sawing timber	2,000
To John Blake, Esq. to assist him in carrying on his scheme of transporting Fish to London by land carriage	2,500
	<u>£. 17,500</u>

Subsequent to 1788.

Parliament granted to Mr. Elkinston for discovering his mode of draining land	1,000
To Mr. John Davis, for his discovery of the method of cleaning smutty wheat, granted 1800	1,000
To be distributed by the Board of Agriculture in 1801, in premiums for Essays on breaking up of grass lands	800
To Thomas Foden, Esq. towards enabling him to prosecute a discovery made by him, of a paste as a substitute for wheat flour in 1801	500
To Dr. Jenner, for promulgating his discoveries of the vaccine inoculation in 1802, a reward of	10,000
1807 a further reward of	20,000
To Dr. Edmund Cartwright, for various mechanical inventions, granted in 1809	10,000
To Captain Manby, as a reward for his invention of effecting a communication with ships stranded, and for expenses in carrying into execution his plans for saving the lives of ship-wrecked mariners, granted in 1810 and 1812	3,250
To Mr. Greathead, boat-builder, for his invention of a life-boat, affording greater security to the lives of seamen and others, in cases of shipwreck	1,850
To Mr. Crompton, for inventing the machine for spinning cotton, called the Mule	5,000
To Dr. Smyth, for his discovery of nitric fumigation to prevent the communication of contagion, in 1813	5,258
Miscellaneous rewards at various times	1,305
	<u>£. 77,463</u>

Appendix (B.)

Papers
delivered in by
John Farey, Esq.
8 June 1829.

Appendix (B.)

A LIST of the most important cases of TRIALS at LAW, respecting PATENT RIGHTS, which have been reported in books of cases, or cited by Judges, as containing the principal decisions of the Courts of Justice thereon, since the Statute of Monopolies, 21 Jas. I. ch. 3. 1623: With extracts and quotations of the principal decisions of the Judges, as reported in the books of cases which are received as authentic reports, by the Courts.

Salkeld's Reports, Vol. II. p. 446. In the case of *Edgeberry* against *Stephens*, in the Court of King's Bench, it was decided by Judges Holt and Pollexfen, that a Patent may be granted for a foreign invention.

"If an invention be new in England, a patent may be granted for it, though it was practised beyond the sea before; for the statute (21 Jas. I.) speaks of new manufactures within this realm; and if they be new here, it is within the statute, which was intended to encourage new devices, useful to the kingdom, and whether learned by travel or by study, it is the same thing."

This case was cited by Lord Chief Justice Eyre, during the trial of Boulton and Watt against Bull, in 1795, as "almost the only case that is to be found upon patent rights, under the saving of the statute of Jas. I. It establishes, that the first introducer of an invention practised beyond sea, shall be deemed the first inventor. The exposition of this statute, as far as usage will expound it, has gone very much beyond the letter; the words new devices are substituted for, and used as synonymous with new manufacture."

Jessop's case, of a Patent taken for a whole Watch, when the invention was only a particular Movement in a Watch. The Patent was therefore set aside.

Cited during the trial of Boulton and Watt against Bull, in 1795, by Mr. Justice Buller, who said, "A patent for an addition is good, but it must be for the addition only, and not for the old machine too. If the patent for an addition be confined to the invention, it can give no right to the whole machine or to any thing beyond the invention." "May not other persons in the trade buy the new movement, and work it up in watches made by themselves? If men do go to the inventor for the whole machine improved, it is an advantage he gets from the option of mankind, and not from any exclusive right or monopoly vested in him."

Buller's Nisi Prius, p. 75. In the case of the King against *Mussary*, tried Michaelmas Term, 12 Geo. II. the Chief Justice Lee laid down the following general rules:

1. Every false recital in a thing not material will not vitiate the grant, if the King's intention is manifest and apparent.
2. If the King is not deceived in his grant by the false suggestions of the party, but from his own mistake, upon the surmise and information of the party, it shall not vitiate or avoid the grant.
3. Although the King is mistaken in point of law, or matter of fact, if that is not part of the consideration of the grant, it will not avoid it.
4. Where the King grants, by his "especial grace, certain knowledge, and mere motion," those words occasion the grant to be taken in the most liberal and beneficial sense, according to the King's intent and meaning expressed in his grant.
5. Although in some cases the general words of a grant may be qualified by the recital, yet if the King's intent is plainly expressed in the body of the grant, the intent shall prevail and take place.

Dollond's case. An action for infringement of his Patent of 1758, for a new method of making the object glasses of Refracting Telescopes. The Patent was supported. This was a most important invention.

Objection was made, that a patent for a mere method could not be sustained; also, that the specification merely described the principle, but not the mechanical construction: it stated, that the new object glass is a compound of two or more glasses put close together, whereof one was concave, and the other convex; those glasses being made of glass of different refractive qualities, and each glass adapted to the other, so as to correct the errors arising from the refrangibility of light (making coloured rays), and also the errors arising from the spherical surfaces of the glasses (making distorted images.) It was proved that a Mr. Hall had made such glasses in 1720, long before the date of the patent, but he never disclosed the secret.

This case was cited during the trial of Boulton and Watt against Bull, 1795, by Mr. Justice Buller: "As Dollond first made it public, he was held to be considered as the first inventor." "Dollond's telescopes are certainly a manufacture within the statute (21 Jas. I.): they consist of principles reduced into form and practice; and the patent is for glasses completely formed," not

Note.—The articles printed in Italics in this list, are such as have been collected from general reading, or from Mr. Farey's own recollection, but which he has not verified by reference to authentic books.

"not for mere principles. The specification describes the manner in which the invention is to be carried into effect, with all the perspicuity of which the thing is capable." Also by *Mr. Justice Heath*, "I consider Dollond's patent to be substantially for an improved machine. A patent for an improvement of a refracting telescope, and a patent for an improved refracting telescope, are in substance the same. The same specification would serve for a patent taken in either of those terms." And by *Chief Justice Eyre*: "Dollond's patent was perhaps objectionable, being for the method of producing a new object glass, instead of being for the new object glass produced; because the mechanism or process by which it was produced, though perhaps new, will be only useful as producing the new article."

Appendix (B.)

Papers
delivered in by
John Farey, Esq.
8 June 1829.

Morris against Branson. An action for infringement of *Morris's Patent of 1764*, for a Machine with a set of working Needles to be applied to a Stocking Frame, for making Oilet Holes, or Net Work in Silk, Thread or Cotton. Tried at Westminster after Easter Term 1776, before Lord Mansfield. Verdict for the Patentee.

Buller's Nisi Prius,
p. 77.

Objection was urged that a patent could not be maintained for an addition only, and *Bircot's case* (15 Elizabeth) was cited. Lord Mansfield said he had received a letter on that point, from one of the jurymen, which he mentioned to all the Judges; "that objection would go to repeal almost every patent that was ever granted:" his Lordship did not give a direct opinion, but a verdict was given for the patentee, with 500*l.* damages, and no motion was made in arrest of judgment. This case was cited during the trial of *Boulton and Watt against Bull* in 1795, by *Mr. Justice Buller*, who said, "It may be collected that Lord Mansfield thought the above patent good; and since that time it has been generally received in Westminster Hall, that a patent for an addition is good, if it be for the addition only, and not for the whole machine too." Also by *Mr. Justice Grose*, on the trial *Hornblower v. Boulton* in 1799: "If a patent could not be granted for an addition, it would be depriving the public of one of the best benefits of the statute of 21 Jas. I."

About the year 1770, a considerable and increasing trade had grown up at Nottingham, in weaving mitts, handkerchiefs, &c. in open knitted work, by stocking frames, with additional machinery. They all originated from *Morris's patent of 1764*; and several other patents were taken within fifteen years after that. The courts were often occupied with trials for infringements of them, but they are not reported. It appears that *Bircot's case*, in *Queen Elizabeth's time*, was often quoted, and also *Sir Edward Coke's opinion* in his *Institutes*, that a patent cannot be for an addition to an old manufacture; but in the end *Morris's patent* was fully established, and some subsequent ones were set aside, as being on his principle.

Some patentee was nonsuited on the ground that his patent was taken for a new invention, when in fact it would not work alone without the old machine: this was stated in argument before Lord Loughborough, at the trial of *Arkwright v. Nightingale* in 1785: he said, "that objection has been overruled. In all the oylet-hole work patents, they are for additions to the old stocking frames, and they are not so described. I tried one of those causes last term, when objection was made to the description in the patent being inaccurate. I was of opinion that the description of what was invented, was to be looked for in the specification, but it made no reference to the old machine." The same was the case with *March's patent* two years ago.

Liardet against Johnson. An action for infringement of *Liardet's Patent of 1773*, for a Composition or Stucco, called Adam's Oil Cement for covering the Walls of Houses. Tried in the King's Bench at Westminster after Hilary term 1778, before Lord Mansfield. The Patent was set aside.

Buller's Nisi Prius,
p. 76.

The term of this patent had been extended by an Act of Parliament in 1776.

The general questions on Patents are,—
1. Whether the invention were known and in use before the patent; 2. Whether the specification is sufficient to enable others to make it up. The meaning of the specification is, that others may be taught to do the thing for which the patent is granted; and if the specification is false, the patent is void; for, after the term, the public ought to have the benefit of the discovery: hence the law requires, as the price the patentee should pay to the public for his monopoly, that he should, to the very best of his knowledge, give the fullest and most sufficient description of all the particulars on which the effect depends. *Dr. James*, in the specification to his patent for fever powders, only mentioned the ingredients of which they are composed, but omitted the pro-

portions or quantities, and that would have been fatal to the patent if he had ever ventured to bring any action for infringement. In a case of a patent for trusses for ruptures, the patentee omitted what was very material for tempering the steel, which was rubbing it with tallow; for that Lord Mansfield held it void. Inventions are of various kinds; some depend on the result of figuring, others on mechanism, &c.; others depend on no reason, no theory, but a lucky discovery. Water tabbies were discovered by a man spitting on a floor-cloth, which changed its colour, whence he reasoned on the effect of mixing water with oil or colours. This must, in the nature of things, depend on experiments; and others must depend on the proportions of the things used in the composition.

Williams against Brodie. An action for infringement of *Williams's Patent for a Stove*, with a Pipe for conveying Air into it. The Patent was set aside.

The merit of the invention was acknowledged, but the specification described the machine altogether, covering the old stove, which was an existing thing, instead of describing it as a new application of a new invention upon an old thing; hence a verdict was given for the defendant. Mentioned by *Mr. Erskine, Counsel*, on the Trial of the King against *Arkwright* in 1785.

Appendix (B.)

Papers
delivered in by
John Farey, Esq.
8 June 1829.

Arkwright against Mordaunt. An action for infringement of Richard Arkwright's Patent dated 16 December 1775, for certain Machines for preparing Silk, Cotton, Flax and Wool for spinning. Tried in the King's Bench, after Trinity Term, July 1781. Verdict against the Patentee.

On the ground that the patent was void, from obscure and incomplete specification of the invention.— Note. Eight other similar actions had been entered for trial, but after this verdict they were dropped. No motion was made for a new trial. Another action was brought to trial in 1785.

In 1782 Mr. Richard Arkwright printed a case for the consideration of Parliament, relative to his invention of an Engine for spinning Cotton into Yarn;

With his reasons for applying for an Act to confirm, connect, and consolidate his two patents (one dated 3 July 1769, for spinning machines, and the other dated 16 December 1775, for preparing machinery), so as to preserve to him the full benefit of his inventions, during the remainder of the term of the last patent.

It was proved during the trial, the King against Arkwright in 1785, that such a paper had been printed in 1782, and it was read in court; but it does not appear whether it was really brought before Parliament. This document is deserving of notice, because it states the origin of the invention of that spinning machinery, which has since grown to become an object of national importance.

Between 1732 and 1742, one Paul invented, and obtained a patent, for an engine for spinning of cotton; it was first tried in London, and afterwards at Nottingham, and much money spent, but without success. Also between 1752 and 1762, various machines were constructed by different persons for spinning cotton, wool, &c. into many threads at once, but without success.

In 1767, James Hargrave of Blackburn, in Lancashire, succeeded in making a machine (since called Spinning Jenny) to spin 20 or 30 threads at once: his invention occasioned a riot amongst the work-people, by which he was obliged to leave the country; he went to Nottingham, and obtained a patent, but it was infringed, and an association was formed against him, which prevented his prosecuting the infringers: he died in obscurity and distress, though his invention came into use.

Mr. Richard Arkwright, after many years study, brought his spinning machinery to bear about 1768: he was a native of Lancashire; but fearing the same fate as Hargrave, went to Nottingham, and obtained a patent, dated 3 July 1769, for a machinery for making web or yarn of cotton, flax, or wool. He afterwards found it necessary to apply the same principles to the preparation, and took another patent, dated 16 December 1775, for certain machines for preparing silk, cotton, flax and wool for spinning. During five years after the date of his first patent, Mr. Arkwright and his partners expended 12,000*l.* in machinery and buildings before any profit was made. The last invention was a very important addition to the first; and by combining them, excellent yarn, or twist, was at last produced; but there was still much difficulty in establishing a trade; for the cotton manufacturers would not have the new yarn at any price, and the proprietors were

obliged to weave the yarn, into stockings, and into calicoes; but the latter was restricted by the Excise, which rendered relief by an Act of Parliament necessary.

The manufacture of yarn being at length fully established, the demand for it became too great for the patentees to supply, and then they sold licenses very extensively, so that at least 60,000*l.* has been expended in consequence of such grants. Mr. Arkwright and his partners have expended upwards of 30,000*l.* in buildings and machinery in Derbyshire, and above 4,000*l.* in Manchester; and they have lost not less than 5,000*l.* or 6,000*l.* by injuries from mobs, and from fire. The saving of labour by this machinery is several hundred thousands per annum, and yet trade is so greatly increased, that many more people are employed, and can earn a comfortable maintenance, than were employed before. The same inventions may be applied with equal advantage to prepare and spin wool.

To prevent his inventions getting abroad to foreigners, Mr. Arkwright purposely omitted to give so full and particular a description of his inventions, in the specification of his last patent, as he would otherwise have done, believing, from the concluding clause in the patent, that he need not so fully describe. His patent right being largely infringed, he was obliged to prosecute some infringers, although an association was formed to resist him; but on a trial in the King's Bench in July 1781 a verdict was given against him, on the ground that his specification was not as full and accurate as the law requires. Having established a business that already employs above 5,000 persons, and a capital of not less than 200,000*l.* he hopes to be relieved by Parliament, from the consequences of an unintentional error.

Arkwright against Nightingale. An Action for infringement of Arkwright's Patent, 16th Dec. 1775. Tried in the Common Pleas, 17th Feb. 1785, before Lord Loughborough. Verdict for the Patentee.

It was pleaded, that it would be highly for the public benefit, that the patent should be set aside. Lord Loughborough said: "We must never decide private rights, upon any idea of public benefit; a cause between individuals cannot be determined upon consequential reasons, that it would be beneficial to the public that one should prevail. The law has established the right of patents for new inventions, if certain conditions are complied with. If the present had been a question of damages, I would have admitted evidence to show to what extent persons had practised the invention, on the faith of the former verdict against the patentee (in 1781); but only nominal damages are now asked. The clearness of the specification must be taken from persons in the business, having skill on the subject; its intelligibility is proved by several witnesses who have made the machinery, from no other instructions than what was conveyed by the specification." On this the verdict was for the plaintiff.

Note.—It was commonly insinuated, that collusion was used between the parties on this trial, to keep back all evidence against the specification, and thus obtain a verdict that should support the patent. A scire facias was soon after brought against the patent, and it was set aside.

Davies,
Collection of Cases
on Patents, p. 37.

The

The King against Arkwright. A scire facias to repeal Arkwright's Patent, 16th Dec. 1775. Tried in the King's Bench at Westminster after Trinity Term, 25th June 1785, before Mr. Justice Buller. Verdict for the Crown.

During this trial, the Judge would not hear evidence on the allegation "that the patent is prejudicial to the King's subjects in general," which was explained to mean, that the invention could only be worked here with a monopoly, when it might be worked in other countries without, and thus it endangered the removal of the trade. No notice having been given to the patentee of the particular facts which made the patent prejudicial, he could not come prepared to answer the objection, "it is merely consequential, and a question of law, whether the patent is prejudicial or not. The record should state what facts are to prove the general inconvenience, and then the patentee would know what he comes to answer; and if established by the jury that such facts existed, then it would be a question of law whether it was an inconvenience." It was contended, that the specification was obscure, ambiguous and defective; that it contained nothing that was new at the date of the patent, and that several things were not invented by Arkwright; a most voluminous evidence was given on both sides.

Mr. Justice Buller: "No proceeding by scire facias to repeal a patent, has occurred within my memory, though in former times they were certainly very frequent." Respecting the specification, "Different evidence has been produced now, from that on either of the former trials." "A patentee must disclose his secret in his specification, so that others may be taught by it, to do the thing for which the patent is granted; it must teach what the art is, and put the public in possession of the secret, in as ample and beneficial a way as the patentee himself uses it. There is strong evidence of several sensible men, that know something of this particular business and mechanics in general, that they cannot do it, then it is not sufficiently described, to support the patent. In the case that Mr. Arkwright printed for the House of Commons, he admits that he has not properly described how the machines were made. Some articles in the specification are proved to be of no use; why load it thus? that could answer no purpose but to perplex." The specification does not distinguish between what is intended for preparing cotton, and what for flax or wool, although they require very different preparation.

On the other points, whether it is a new invention, and whether it was invented by the patentee; "The law in general is very different on them, from what I have stated as to the specification; many parts of a machine may have been known before, yet if there be any thing material and new, which is an improvement to the trade, that will be sufficient to support a patent;" but it must be for the new addition only.

The beater or hammer for breaking seeds, and fining flax, is admitted not to be new. Another figure is admitted to have nothing to do with the machine, "it is very difficult to say how, with a good motive, it came into the plan." The feeding-cloth for supplying cotton to the carding machine, and also the crank, and comb, for stripping off the cotton therefrom, are proved to have been invented, and used by others, before the patent. The rollers for drawing out the cotton in preparing, are imperfectly described, and were made before the patent; they are the same as were in Mr. Arkwright's first patent of 1769 for spinning; and evidence is given that the first invention was communicated to him in 1767 by John Kay, who had made a model for Thomas Hayes, the real inventor. The two kinds of spindles and bobbins, which are represented as what may be used for roving, instead of the revolving roving-can, are admitted to be of no use.

On the 10th November 1785, a Motion was made for a New Trial, but it was refused; and on the 14th, Judgment was given to cancel Mr. Arkwright's Patent.

Observations.—The inventions for which Mr. Arkwright took his two patents for spinning and preparing, have proved of immense value to the nation, they are universally employed for one great branch of cotton-spinning, called twist, for strong hard cotton thread, and still remain nearly on the system that Mr. Arkwright himself established, during the patents; also, when combined with the previous invention of Hargrave's spinning-jenny (which was done some years afterwards by Mr. Crumpton) in what is called the mule, they form the other branch of cotton-spinning for fine and soft yarn. The spinning of long wool, and flax, and the preparing of flax (after the stages of combing or heckling), are modifications of Arkwright's system; and also the preparing of short wool for woollen cloth, the spinning thereof being done by Hargrave's jennies.

The nation is chiefly indebted to Hargrave, Arkwright, and Crumpton, for this great accession of means of wealth. All that was proved on the above trials respecting the use of the invention before the patent of 1775, was amongst persons who had been set to work by what Arkwright had done under his first patent of 1769 for spinning, and many had been his workmen; they were none of them persons who were capable of establishing any thing, if it had not been for him. The spinning ma-

chinery, which Arkwright constructed to a considerable extent under his first patent, showed itself on trial to be incomplete without a corresponding system of preparing machinery, the want of that was also felt by every one who had set up such machines (and most of whom had done so in infringement of his first patent); he was himself incessantly engaged in experimenting, organizing, and arranging such a system; and others who were watching for the same object, (and getting away his workmen whenever they could,) appear to have used most of the items of his invention before his patent, and yet it is certain, by the subsequent results, that no one attained success in the system like Arkwright; of that success, the greatest part depended upon arrangements and judicious combinations, none of which were explained in his specification, but only an obscure statement of the principal items of invention, and most of those had been used before the patent by others, though without any great advantage, for want of suitable combination. His specification was unquestionably most deficient; but the substantial merits of his invention were much greater than what appeared during the above trials. It is worthy of remark, also, that those items of his specification which were pronounced useless, and which it was assumed that

Appendix (B.)

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Printed Report of
the trial in folio,
Davies, p. 61.

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that he must have introduced with an intent to confuse, are the origin of almost the only really important inventions which have been added in modern times to the system of preparing that Arkwright himself established in his own mills at Cromford in Derbyshire, during the existence of his patents.

Of the three inventors of spinning, Hargrave, Arkwright and Crompton, to whom the nation have owed so much, the first was persecuted, and died in the greatest poverty, amidst a population who were rising to opulence by his means. Arkwright, possessed a vigour of mind to command, control, and instruct workpeople, far beyond the talent of a mere artist or inventor, and succeeded in realizing a princely fortune by his manufactory; but his money was not gained by virtue of his inventions, for the bulk of it was acquired after his

patent was set aside; and others who invented nothing, but merely copied what he did, made immense fortunes by spinning as well as himself. Crompton, whose combination of Hargrave's and Arkwright's inventions in the mule, has much more than doubled the national advantages conferred by his predecessors, was, like Hargrave, ruined in his circumstances, and languished in poverty during a long life, in the very towns which had grown up from insignificance to wealthy importance by the practice of his invention. In 1812, his case reached the knowledge of Parliament, and 5,000*l.* reward was given him; but it came too late to have the effect of removing the established impression, that an inventor is almost certain to be ruined, even if his invention succeeds, and proves ever so valuable to others.

Arkwright's case was thus cited by *Mr. Justice Chambre*, on the trial of *Taylor v. Hare* in the Common Pleas, 1805, "his patent was not overturned till near the time when it would have expired; very large sums had been paid for patent machinery, of which sums the main part was for the privilege of using the patent right; but no money, which had been so paid, was ever recovered back."

East's
Term Reports,
XI. 108.

The King against Else. Proceedings to repeal Else's Patent of 1780, for a new manufacture of Lace, called Ground Lace. Tried in the King's Bench, after Michaelmas 1785, before Mr. Justice Buller. Verdict for the Crown.

Davies,
p. 144.

The specification claimed the making of lace, of silk and cotton thread mixed, without confining it to that particular mode of mixing them upon the frame, which constituted the merit of the invention. Lace had been previously made of silk and cotton mixed, though not successfully, or in the same way as the patentee practised. A patent for an invention which is only an improvement, must not be extended to the whole of the old article, or the patent is void. Cited by Mr. Justice Park, on the trial *Bovill v. Moore*, in 1816.

Durnford & East's
Term Reports,
Vol. I. p. 602.

Davies,
p. 145.

Turner against Winter. An Action for infringement of Turner's Patent of 1780, for "a method of producing a Yellow Colour for painting in Oil or Water; making White Lead; and separating Mineral Alkali from common Salt; all to be performed by one single process." Tried in the King's Bench at Westminster, before Mr. Justice Buller, and a verdict given for the Patentee. Motion was made, 5 Feb. 1787, to set this verdict aside.

The specification was very obscure; it directed lead to be calcined to a calx, and mixed with half its weight of sea salt, and a sufficient quantity of water to dissolve it; the mixture being ground fine, was then to stand until the lead changed to a good white, and the salt was decomposed; the alkali was then separated by water. The yellow colour was produced by calcining the lead, (after the alkali was thus separated) until it acquired the required colour, which would be of different tints, according to the degree of heat. The white lead was to be finished by repeated washing and bleaching. Some materials were enumerated, as minium, red lead, fossil salt, salt water, &c. which would not answer the purpose; and the white substance obtained was not what is commonly called white lead. Also the calcination required to be continued to fusion, but it was not so stated in the specification.

Mr. Justice Ashurst: "If there is any unnecessary ambiguity introduced into the specification, or any thing which tends to mislead the public, the patent is void. Here is a doubt upon the evidence, that unnecessary words have been added without any good view. The patent is for making white lead and two other things; if the process, as directed in the specification, does not produce that which the patent professes to do, it is void." And *Mr. Justice Buller* said, "If the novelty or effect of the invention be disputed, the patentee must show in what his invention consists, and that he produced the effect proposed in the patent in the manner specified. The evidence shows that the process is not accurately described in the specification; that it fails to produce white lead, and that the yellow colour alone is a valuable invention. If the patentee says, that by one process he can produce three things, and he fails in any one, the consideration of his merit, and for which the patent was granted, fails; and the Crown having been deceived in the grant, it is void."

Note. No further proceedings are reported, but the patent appears to have been established, for in 1792 an Act was passed (32 Geo. III. c. 72,) to extend the term of the patent eleven years from that time. The preamble states that he "obtained one verdict," (a new trial having been granted.)

Bramah against Hardcastle. An action for infringement of Bramah's Patent of 1784, for a Water Closet. Tried Trinity Term 1789, in the King's Bench, before Lord Kenyon. Verdict for the Patentee.

The merit of the patent water closet was proved; but it was contended that the patent was taken for the whole water closet, when the invention was only an improvement on the water closets used before. *Lord Kenyon*: "In my opinion the cause mainly depends on this, whether the thing granted by the patent be entirely new; I admit one part is very ingenious and perfectly

“fectly new, but it is not claimed by the patentee. Unlearned men look at the specification and suppose every thing new, that is there; if the whole be not new, it is hanging terrors over them. In a former machine there were parts in principle the same, obtaining the same effect, whether those means differ in shape or not, is not material; I think the patent void, those parts not being new.” The jury however, found for the plaintiff.

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Oldham against Langmead. An action brought by the Assignee of a Patentee, against the Patentee himself, for infringement, by practising his invention contrary to the assignment. Tried before Lord Kenyon after Trinity Term 1789.

Durnford & East's
Term Reports,
III. 439.

Who would not permit the patentee to show that it was not a new invention, against his own deed; for after he had conveyed away his interest in the patent, he ought not to attempt to set up that he had no right to convey; he was estopped by his own deed from that defence.

Hayne and another against Maltby. An action on an agreement made with the Assignees of Taylor's Patent 1778, for a Machine to be added to a stocking frame to make Point Net, or imitation of Lace. Tried in the King's Bench, before Lord Kenyon, 17 Nov. 1789. Judgment for the Defendant.

Durnford & East's
Term Reports,
III. 438.

Davies, p. 156.

The invention being the same as Morris's patent 1764, and from other causes, the patent was admitted to be void. The case of *Oldham v. Langmead* was cited, to show that the defendant by entering into the agreement, had acknowledged the patent right, and was estopped from pleading against it. Lord Kenyon: “This is a covenant to pay a certain sum, in consideration of the plaintiffs having conferred on defendant an interest in their patent, but now it appears that the patent is void, and yet plaintiffs insist on the agreement. The doctrine of estoppel is not applicable here; for the person supposed to be estopped, is the very person who has been cheated and imposed upon.”

Mr. Justice Ashurst: “In the case of landlord and tenant, as long as the tenant enjoys the estate, he shall not be permitted to deny his landlord's title, because he has a meritorious consideration; but where he expelled by another having a superior title, he may plead it. This patent was used by the plaintiffs in fraud. The only right conferred by the agreement, was that which defendant had before, without any grant from the plaintiffs.”

Mr. Justice Buller: “The agreement supposes an exclusive right to the machine under the patent, and that the right could be conveyed; it is now discovered that there was no such right, and therefore the defendant has not the consideration for which he entered into the covenant. It is like the case of landlord and tenant, after eviction of the latter.”

In the case of O'Reilley ex parte in Chancery, heard in 1790, the great seal was refused to a Patent for representing Italian Operas, in a new house.

Vesey, jun.
Chancery Reports,
I. p. 112.

A warrant had been given for a patent for 31 years, to permit a new Italian Opera to be established, the old opera being stopped by the burning of the house in 1789. Caveats had been entered to prevent such patent being sealed, by claimants under the former patent, (of which $13\frac{1}{2}$ years were unexpired) and others, creditors to the property of the patentees.

The Lord Chancellor Thurlow called upon O'Reilley not merely to answer the objections of his opponents, but also to make out a proper case for the patent, and what the purpose of it was: “All objections to it are open upon these caveats, and the propriety of the grant must be sustained in every particular, even if there had been no caveats against it. Nothing is required from those who oppose a patent, but to show that they have an interest. My office is to see that the King is not deceived, nor his object disappointed. This patent cannot be passed in its present form, for a patent must be taken under proper restraints; this seems to me to be calculated to create more lawsuits than I can form any idea of; and it is not convenient that such an institution (which the King may provide) should be followed by such consequences. There are considerations which do not rest with me, to be determined, but I shall represent the case to the King.”

In the case of Cameron against Grey, on a motion to change the venue in an action for infringing a Patent, from Middlesex to Northumberland; before Lord Kenyon in the King's Bench, 13 June 1795; the change was refused.

Durnford & East's
Term Reports,
Vol. 6. p. 363.

“The patent which is the substratum of the action, being at Westminster, affidavit cannot be properly made, that the cause of action arose wholly in Northumberland, and not elsewhere.”

Boulton & Watt against Bull. An action for infringement of Mr. Watt's Patent of 1769, “for his method of lessening the consumption of Steam and Fuel in Fire Engines,” the term of which had been prolonged by an Act, 15 Geo. III. for 25 years from 1775. Tried after Trinity Term 1793, in the Common Pleas. Argued in Easter Term, 16th May 1795, but the opinions of the Judges being equally divided, no judgment was given.

Henry Blackstone's
Reports,
Vol. II. p. 463.

Two-thirds of the patent right had been assigned to Mr. Boulton in 1777, for the remainder of the prolonged term. The infringement was proved, and also the sufficiency of the specification, to enable a mechanic acquainted with the fire-engines previously in use, to construct fire-engines, producing the effect of lessening the consumption of fire and steam in fire engines, on the principle invented by Mr. Watt. A verdict given for the patentees; but the validity of the patent right being disputed on points of law, a case was reserved for the opinion of the full court;

Davies, p. 162.

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court; and it was argued twice in 1795, at great length, before all the judges. 1st. Whether the patent was good in law, and continued in force by the Act of Parliament. 2d. Whether the specification was in point of law sufficient to support the patent.

The novelty, merit, and importance of Mr. Watt's invention was admitted; but it was argued that a patent for a method, cannot be a new manufacture, within the meaning of the statute 21 James I.; that the specification only sets forth unorganized principles, and not any engine; that the Act 15 Geo. III. by which the patent was prolonged, was for certain engines of Mr. Watt's invention, when he had only invented improvements on engines known before.

Mr. Justice Rooke treated the objections as formal: Method of saving fuel in steam-engines, obviously implies some improvements in their construction, and those the jury have decided to be sufficiently specified. The term 'principles,' used in the specification, is equivocal, for it may denote, either the radical elementary truths of a science, or those consequential axioms which are founded on radical truths, but which are used as fundamental truths by those who do not have recourse to first principles; taken in the latter sense, principles, as used in the specification, may mean new mechanical employments of radical principles already known; and the means of employing are set forth.

Some part of the specification may be considered as merely theoretical, and I do not think an action could be maintained for breach thereof; because the patentee cannot anticipate protection before he is entitled to it by practical accomplishment; the most material articles were accomplished at the time of the patent, and they have been infringed. The mechanical improvement, and not the form of the machine, is the object of the patent; and if the mechanical improvement is intelligibly specified, (of which the jury must be the judges,) whether the patentee calls it principle, or method, or invention, we may protect him.

Mr. Justice Heath gave weight to the objections: The invention is to be put in practice by means of machinery, the organization of which may be the subject of a patent, but principles cannot. The term 'new manufactures' in the statute, means a vendible substance, either machinery, or a substance produced by a process. That which is the subject of a patent ought to be specified, and it ought to be that which is vendible, or it cannot be a new manufacture. I consider that Dollond's patent was substantially for an improved machine. The grant of a method is not good because uncertain.

The finding of the jury, that steam-engines may be made by the specification, is not conclusive; for the patent extends to all machinery that may be made on this principle, and that is more than is specified; indeed it seems impossible to specify a principle and its application to all cases, which is an argument why it cannot be the subject of a patent.

Mr. Justice Buller was also against the patent: The jury have not decided wherein the invention consists; it is admitted that there was no new mechanical construction invented by Watt, but his discovery was a principle, the method of applying which is set forth in the specification, but it does not describe in what manner any new machine is to be constructed, how it varies from the old one, or in what way the improvements are to be added. A principle is the first ground and rule for arts and sciences, the elements and rudiments of them. A patent must be for some new production from those elements, not for the elements themselves. If the principle alone be the foundation of this patent, it cannot stand, though the addition may be a great improvement. I think it impossible to support a patent for a method only, without having carried it into effect, and produced some new substance. Patents must be for new manufactures; and whether the manufacture be with or without principle, produced by accident or art, is immaterial. Dollond's patent was for object glasses, and the specification stated the method of making them. A patent may be for a specific compound article if it is new, although the articles of which it is composed are known.

I consider that principle in the patent, and engines in the Act, mean the same; the patent is granted for the engine, but the invention was only an improvement. The admission that there was nothing new in the machine is decisive against the patent. Notwithstanding Bircot's case in Queen Elizabeth's time, I think a patent for an improvement may be good; that was the case in *Morris v. Branson*; but the patent must be confined to the invention, and nothing beyond. The public have a right to purchase that improvement by itself, without being incumbered with other things. (see *Jessop's case*.) The patentees here claim the right to the whole machine, and I am of opinion the patent cannot be sustained.

Lord Chief Justice Eyre supported the patent: I doubted at first on the trial, whether a patent can attach upon any thing not organized, and capable of precise specification.

We have had many cases upon patents, yet I think the ground was untrodden till this cause was instituted. Patent rights are no where accurately discussed in our books. Sir Edward Coke discourses largely, and sometimes not quite intelligibly, upon monopolies, in his *Institutes*, part 3, chap. 85; but he deals very much in generals, and says little or nothing of patent rights, as opposed to monopolies. He mentions Bircot's case, but the principle on which that was determined has not been adhered to, in modern times.

The statute 21 James I. defines a monopoly to be the privilege of the sole buying, selling, making, working or using any thing within this realm; that is, what is prohibited. The saving by the 6th section is "letters patent for the sole working or making of any manner of new manufacture," obviously leaving the sole buying, selling and using, under the previous general prohibition; and with good reason, because the sole buying, selling and using,

could hardly be brought within the next qualification of the saving clause, "not being contrary to law, nor mischievous to the state." Also the words "any manner of new manufacture," in the saving, fall short of the words "any thing" in the previous prohibition; certainly by usage, the exposition of this statute has gone very much beyond the letter. (see *Edgeberry v. Stephens*.)

The word 'manufacture' is of extensive signification; things made by new composition is the most ordinary sense, and a new piece of mechanism is a thing made. It also applies to the practice of making; all new artificial manners of operating by hand, or by known instruments; to principles carried into practice in a new manner; new processes in any art, producing effects useful to the public. When the effect produced is a new substance or composition, the patent must be for the new substance or composition, without regard to the mechanism or process by which it has been produced,

produced, which though it may be new also, will only be useful as producing the new substance; hence Dollond's patent being for a method of producing, instead of for the thing produced, was perhaps objectionable. Dr. James's patent was for his fever powders, not for the method of preparing them. When the effect produced, is no substance or composition, the patent can only be for the new mechanism, if any is used; or if it be a new method of operating with old mechanism, for the process by which the effect is produced. Mr. Hartley's patent for fire plates is a case of a new method of using old things, but the effect is a negative, no substance at all; nor is new mechanism employed. I would say in the words of Lord Mansfield respecting copyrights, that the patent must be "for a method, detached from all physical existence whatever."

I think we should well consider what we do in this case, that we may not shake the foundation on which so many patents stand; three-fourths of all patents granted since the statute 21 James, are for methods of operating, and of manufacturing, producing no new sub-

stances, and employing no new machinery; many of them inventions of great merit, which ought to stand; many of them probably mere speculations of wild projectors, which ought to fall. Mr. Watt's case shows the merit of a new method of operating with old machinery; our mines cannot be worked without fire-engines, and they are essentially necessary to carrying on many of our principal manufactures; they were before worked at an enormous expense of coals, and any method of lessening that consumption, is a great benefit to the public, as well as to individuals.

After the immense number of patents that have been granted, for methods of using old machinery, to produce substances that were old, but in a more beneficial manner, (and also for producing negative qualities, by which benefits result to the public,) shall it be said by a narrow construction of the word 'manufacture' in the statute, that there can be no patent for methods producing this new and salutary effect, intimately connected as it is with the trade and manufactures of the country? This I am not prepared to say.

There can be no patent for a mere principle, but I think there may, for a principle so far embodied and connected with corporeal substances as to be in a condition to act, and to produce effects in any art, trade or manual occupation; this is, in my judgment, the thing for which Mr. Watt's patent was granted, and is what the specification describes, though it miscalls it a principle; it is not that the patentee has merely conceived an abstract notion, that the consumption of steam may be lessened, but he has discovered a practical mode of doing it; this is very different from a principle; it is a process. If the patent is to be taken, as for a fire-engine, I admit the specification is not sufficient, for it does not specify mechanism of any determinate form, or having component parts capable of precise arrangements. But if the patent be in effect for a method of working fire engines, as its title imports, the specification points out what is to be done, and the jury have found that a workman can execute the improvement, in consequence of the specification. The machinery that the specification does not describe, is not the essence of the invention, but incidental to it.

It has been objected, that it is left unascertained by the specification, to what extent the consumption of steam would be lessened by the invention. To make the patent good, the method must be capable of lessening it so much as to make the invention useful; but more precision is not necessary; the quantity saved must depend upon a great variety of circumstances. Objections have also been made to articles 4th and 5th of the specification, which are rather intimations of new projects of improvements in fire-engines, than relative to the method of saving, which is the object of the patent; they are either very loosely described, or not very accurately conceived. If the defendant had not pirated the invention for lessening the consumption of steam, which is sufficiently specified, but had merely done something to which those questionable parts of the specification were meant to relate, the objection would have been of weight, but the jury have decided the fact of infringement.

Another objection is, that the Act 15 Geo. III. continues the patent for a machine, when in fact the patent is for a method. There is nothing technical in the composition or language of an Act of Parliament; in the exposition of statutes, the intent of parliament is the guide; every statute ought to be expounded, not according to the letter, but the intent; and hence it is that an Act of Parliament may be extended by equity. No authority is cited that a mistake, in point of description in an Act of Parliament of this nature (when the true meaning can be discovered, and when there is a foundation on which the Act can be supported) shall vitiate it. I am not satisfied that the King, proceeding by and with the advice of Parliament (being then under the special protection of the law) is in that situation, that he could be considered as deceived in his grant, nor is any case cited. The specification calls the method of lessening consumption of fuel a principle, which it is not; the Act calls it an engine, which perhaps it is not; but both specification and Acts mean the same thing, and when taken with their correlative, are perfectly intelligible; hence I am of opinion that the Act has continued the patent.

Let it be remembered, that though monopolies in the eye of the law are odious, the consideration of the privilege created by this patent is meritorious; for, to use the words of Lord Coke, "the inventor bringeth to and for the commonwealth, a new manufacture, by his invention, costs and charges. I conclude that the judgment should be for the patentee."

The court being thus equally divided in opinion, no judgment was given.

Boulton & Watt against Bull in Chancery. Proceedings had been commenced in Chancery long before the above trial in the Common Pleas; and an Injunction had been issued to restrain Bull from infringing Watt's Patent until its validity could be tried at law. The Court of Common Pleas being equally divided in opinion on the above case, and no judgment given, application was made by Bull to the Court of Chancery to dissolve the Injunction. Heard 2 June 1796, before Lord Loughborough. The Injunction was continued.

Lord Chancellor Loughborough: "I cannot put the patentees out of possession of their right upon the difference of opinion of the Court of Common Pleas, for that is not the fault of the patentees,

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patentees, and does not shake their right. The opinions of the Judges on both sides are deserving of great respect, but the verdict, though it has failed of effect, strongly supports the patent right, and is not to be disregarded. If nothing can be done upon it, there must be another action; and in the mean time the injunction must be continued. I will not put the patentees to compensation, or disturb the possession of their specific right." "It is of notoriety that Watt's fire engines have been erected in many parts of the country with great advantage."

On the defendant's desiring that the action might be brought in the King's Bench, the Lord Chancellor said, "I will not lay them under any terms in bringing the action."

It appears from what was afterwards said by the Lord Chancellor, in *Dilly v. Doig*, that several other bills had been filed against other parties for violating Watt's patent.

This case was cited by Lord Chancellor Eldon in giving judgment respecting the Universities of Oxford and Cambridge *v. Richardson* in 1802: "If a party gets a patent, and puts his invention in execution, and has proceeded to a sale, that may be called possession under it, however doubtful it may be, whether the patent can be sustained; for possession under colour of a title, is ground enough to enjoin, and to continue the injunction until it shall be proved at law, that it is only colour and not real title. Can it be said that Watt's patent right was not doubtful? The Court of Common Pleas were divided upon its validity. Upon the first argument in the Court of King's Bench they were inclined to hold it bad; but they altered their opinion, and decided in its favour. This court enjoined the infringers, all the time during the pendency of the law proceedings, on the ground that the patentees had possession of the invention, under colour of the title given by a patent, though questionable in that degree."

Durnford & East's Term Reports, Vol. VIII. p. 95. *Hornblower and Maberley against Boulton & Watt. A Writ in Error in the Court of King's Bench against a Verdict given in the Common Pleas, for infringement of Mr. Watt's Patent of 1769, as extended by the Act 15 Geo. III. Judgment for the Patentee.*

Davies, p. 221.

The court of Common Pleas having been divided in opinion in a former case, the defendants in this case brought a writ of error; that the invention for which the patent was granted, was not any organized machine or manufacture, but mere principles only, for which no patent could by law be granted: it was argued twice in the King's Bench in 1798, and an unanimous judgment was given for the patentee, 25 January 1799.

Lord Kenyon, Chief Justice: I am not one of those who greatly favour patents; for though in many instances (and particularly in this) the public are benefited by them, yet, on striking the balance, I think great oppression is thereby practised on inferior mechanics, by those who are more opulent. This patent, explained as it is by the specification, appears to be for a manufacture; the patentee claims a monopoly for an engine composed of material parts, which are to produce the effect described, and the mode of producing, is found by the jury to be so described, as to enable mechanics to construct it. I have no doubt in saying that this is a patent for a manufacture, which I understand to be something made by the hands of man.

Mr. Justice Ashurst: Every new invention is of importance to the wealth and convenience of the public; and when they are enjoying the fruits of a useful discovery, it would be hard on the inventor to deprive him of his reward. The jury have found that the patentee has particularly described his invention, and I think he is in law, as well as in justice, entitled to the benefit which the patent and the Act of Parliament intended to confer on him.

Mr. Justice Grose: The patent and specification are so connected together as to make a part of each other; the patent grants to Mr. Watt the sole use of the method he invented, on condition of his disclosing the invention in the specification; he does so, and describes the principles of the method, and how those principles are to be carried into effect, and it seems to me that he does describe a new manufacture, by which his principle is realized. I do not consider it as a patent for the old engine, but only for the addition to, or improvement of, the old engine, and so the Act considers it. The patent does not claim the making of the old engine. A patent may be had for an addition to an old manufacture, the doubt thereof rests altogether upon *Bircot's case*, and I refer to what was said thereon in the Common Pleas.

The statute 15 Geo. III. must have a reasonable construction, to support, rather than defeat, the intention of the legislature; it recites the patent as a grant of the benefit of making certain engines invented by Mr. Watt, not the original fire-engines, but the improved ones; and the legislature considered it as a patent for the improvement described in the specification, not for a mere method, or for the original engine. A patent cannot be granted for a mere principle; but being granted for a method of making, or doing any thing, and that mode being described, it becomes, in effect, a manufacture for the thing made, not merely for the principle upon which it is made. Where then is the mischief to the public, or how is the intention of the legislature defeated? Whether the patent stiles the manufacture a method, or in any other manner, signifies nothing; the specification must be resorted to, and there I see that by pursuing the method pointed out, a manufacture is produced by the ingenuity of the inventor, and of which the public enjoy the fruit, and the author gets his monopoly for the term. It signifies nothing to either, whether the patent be for the engine as made, or for the method of making it, if that method be sufficiently described.

Mr. Justice Lawrence: According to the recital in the Act 15 Geo. III. Mr. Watt obtained a patent for a mechanical contrivance for lessening the consumption of steam, &c.; the patent recites, that he invented a method of lessening, &c.; the specification states, that the method consists in certain principles, as they are called, which are described. It is clear the legislature understood that the patent was for an engine, and the form of the patent and specification do not contradict this. Engine and method mean the same thing, and may be the subject of a patent. Method is placing several things in the most convenient order, but it may signify a contrivance or device; so may an engine, and therefore I think it may answer the word method. So principle may mean a mere elementary truth, but it may also mean constituent parts. In effect the specification is this; the contrivance by which I lessen the consumption of steam in fire-engines consists in the following principles (that is, constituent or elementary parts) which principles

principles are applicable to all fire-engines, for whatever purposes they may be used, and whatever may be their construction, by an alteration of, and addition to, parts which are common to all, and upon which their powers of working depend.

If the specification had been ever so comprehensive, the patent could not have extended to the whole engine so altered and improved; the patent is for an improvement and addition to old engines, known and in use, and I think is good. The word engine, in its popular sense, is some mechanical contrivance to effect that to which human strength without such assistance is unequal, but it may also signify device; that Mr. Watt used it in that sense, and that the legislature so understood it, is evident from the words engine and method being used as convertible terms; for such a contrivance a patent may be granted; it falls within the description of a manufacture. It seems to me that the specification has stated a definite alteration or addition, which may be made in all fire-engines, and that it describes the same with sufficient accuracy to enable a workman to make it; but that point the jury have decided.

Observation.—Mr. Watt's is the most striking case amongst that very few, where an inventor has been protected in his patent rights, for an adequate length of time, to enable him to perfectly establish his invention, and consequently recompense himself from the use of it. The great perfection which Mr. Watt attained, and the very general use into which he brought his steam engines, for a great variety of applications, was entirely owing to that protection; and it is certain that the public would not have benefited any thing like so much, if his patent had not been prolonged by Parliament, or if it had been set aside at law, as it ought to have been according to the rules laid down in all other cases of patent rights.

The formal objections against his patent, act, and specification, were much stronger than those upon which many other patents have been declared void, and the deficiency of explanation in his specification was a substantial objection; for in fact the public were not put in possession of the invention by the specification; and in Messrs. Boulton and Watt's practice, they took every precaution to conceal the internal structure of their engines, and their means of making them, and succeeded so far in such concealment, that those who began to make Mr. Watt's engines after the expiration of the patent right in 1800, made very defective engines, for want of knowledge of the proper interior structure, and proportions of the parts; and although great numbers were made, no tolerable engines could be obtained, except from Messrs. Boulton and Watt, during several years; and not until persons who had been brought up in their factory, had set up in business for themselves.

Messrs. Boulton and Watt realized large

fortunes by the patent. In addition to their profits as engine makers, they took one-third of the annual savings in fuel, made by their engines, compared with Newcomen's atmospheric engines performing the same work; that produced them a great revenue from Cornwall, where coals are dear, and the engines for draining mines very large, and numerous.

The steam-engine is an invention from which this nation has derived immense wealth during the last century, and increasing means of wealth for the future. After the enunciation of the principle of action had been made by De Caus in 1615, and Papin in 1690, the real inventors of the engine have been Savery in 1698, Newcomen in 1612, Watt in 1769, Trevethick in 1802, Woolf in 1804, and Fulton in America in 1807. Of these, Mr. Watt is the only one, amongst us, who derived any adequate advantage, or recompense for his labours. Mr. Woolf's failure of a recompense was entirely owing to the want of protection by an extension of his term; for his engines came into very general use in Cornwall soon after the expiration of his patent, in place of Mr. Watt's engines, and with such great advantages in economizing fuel, that Mr. Woolf would have been amply recompensed, if his term had been made as long as Mr. Watt's was.

The steam-engine and the other great inventions which have contributed so much to the wealth of the nation in the last century; viz. Lord Dudley's smelting of iron by pit coal; and the spinning machinery of Hargreave, Arkwright and Crompton, have had a very close connection with each other, and are continually used in concert, mutually aiding and promoting each other. The steam engine is connected with almost every useful art.

The King against Boileau. A scire facias to repeal Boileau's Patent of 1798, for a new manufacture of Straw, into Hats and Bonnets. Tried in the King's Bench in 1799. The Patent was cancelled and repealed.

In the case of Dilly against Doig in Chancery, it was decided by Lord Thurlow in 1794, that separate bills must be filed upon every distinct invasion of a Patent by different parties.

The plaintiff being proprietor of the copy-right of Entick's Dictionary, obtained an injunction to restrain defendant from selling a spurious edition, printed at Edinburgh. On application being afterwards made, in Nov. 1794, to extend the injunction to another party, who was also selling such books,

The Lord Chancellor Thurlow said, "The right against the different booksellers is not joint; there is no privity. If he against whom the injunction issued, had transferred the books, I would have followed them. I do not remember any case upon patent rights, in which a number of persons who have all been acting separately on distinct grounds, have been brought before this court as parties; but proceeding has always been against a particular defendant. In the case of Watt's patent, there were several bills filed in this court, not long ago. Motion refused.

Cartwright against Toplis. An action for infringement of Cartwright's Patents of 1790 and 1792, for Machines for Combing Wool. The Patent Right was established; it was prolonged by Act 41 Geo. III. in 1801, which contains a clause, saving Toplis's patent of 1793; and also a certain agreement made between him and Cartwright in 1793.

J. and C.

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Vesey, jun.
Chancery Reports,
II. 486.

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J. and C. Cartwright against Amatt and another. An action for Infringement of Edmund Cartwright's Patents of 1790 and 1792, for Machines for Combing Wool, alledged to be assigned to J. and C. Cartwright. Tried in the Common Pleas before Mr. Justice Rooke, 18 Nov. 1799.

The Plaintiffs were nonsuited, upon a supposed defect in the deed of assignment, which was in some degree conditional as to the actual time of conveying the right. At the time the assignment was made, the patentee had an action pending against Toplis for infringement, and therefore required to retain or reserve the patents for the prosecution of that action. Accordingly the deed of assignment contained a reservation of the right by the patentee, in trust for the benefit of the assignees, until that action should be determined, and stated that the patentee should then assign the patent; but no subsequent deed of assignment was made.

Mr. Justice Rooke thought on the trial that the assignees were not legally constituted, so as to be entitled to sue; but on motion being made to set aside this nonsuit, that Judge said, that on further consideration, he was convinced that the legal interest, became vested in the assignees, immediately on the determination of the suit that was pending when the assignment was made; the rest of the Court were of the same opinion.

The action was afterward tried in the Common Pleas, Easter Term 1800, before Lord Chief Justice Eldon. Verdict for the Patentee.

Lord Eldon remarked that patents were to be considered as bargains between the inventors and the public, to be judged of on the principle of keeping good faith, by making a fair disclosure of the invention, and to be construed as other bargains.

Note.—The terms of Mr. Cartwright's patents were extended 14 years, from 1801, by Act of Parliament, 41 Geo. III. c. 133. And in 1809 he had a Parliamentary reward of £. 10,000.

Rowntree against ——— An action for infringement of his Patent of 1798, for a method of applying Fire for heating Boilers, &c. Tried 3d Nov. 1800, in the Common Pleas before Lord Eldon. The Patentee nonsuited,

Because the Jury declared their opinion, from the evidence, that the specification was not sufficiently clear to enable an ordinary tradesman to put the invention in practice.

Vesey, jun.
Chancery Reports,
Vol. VI. p. 599.

Koops ex parte in Chancery. A Petition to dispense with the enrolment of the Specification of Koops' Patent, 1801, for making Paper from Straw, &c.; that the specification might not be made public until application could be made to Parliament to keep it concealed, and thus prevent foreigners getting the invention. Heard 22d January 1802, before Lord Eldon, who dismissed the Petition, because the time allowed in a Patent which is sealed, cannot be extended by any authority except an Act of Parliament.

Lord Chancellor Eldon: "A clause for this purpose was inserted in an Act of Parliament last Sessions, but was universally rejected. If an invention is pirated, and an action is brought, the specification must be produced. The King's subjects have a right to see the specification, that they may not throw away their time and money, upon what the patentee might afterwards call an infringement of his patent, but which they would not have done, if they had seen the specification. I cannot enlarge the time allowed by the patent for specifying, if the patent is sealed, for it is void, if that proviso is not complied with. You should have applied to the Attorney General before, for a longer time to be allowed in the patent itself, upon the special circumstances. I cannot take the great seal from a patent, and repeal it, in the most essential point. You can do nothing, except by an Act of Parliament, to enlarge the time mentioned in the patent."

Vesey, jun.
Chancery Reports,
Vol. VI. p. 708.

In the case of the Universities of Oxford and Cambridge against Richardson, in Chancery, to restrain the printing of books contrary to the Patent to the Universities and to the King's Printer. Heard in 1802.

The Lord Chancellor Eldon said, Can it be sustained, that the King's subjects in Ireland, have, notwithstanding the patent to the King's printer in Ireland, a right to introduce into that country, books printed by the King's printer in Scotland, under his patent; or vice versa?

If a patent for an invention is granted for England, it does not extend to Ireland, but a distinct patent may be granted for Ireland, under Great Seals, which are still kept distinct for that purpose amongst others; and time is allowed for the enrolment of one patent, on account of the purpose to get a patent elsewhere. The right under a patent for one country, is confined to that country, and would not allow the patentee to bring the article for sale into the other country, where a patent was in force for the same thing. If any of the King's subjects buy an article in Ireland, as a watch or a book, and bring it here, where there is a patent for it, I do not know whether it might not be sold as part of his effects, for that belongs to the necessities of the habits of life, but those articles cannot be brought here for the purpose of trading.

Tennant

Tennant against ——— *An action for infringement of Tennant's Patent of 1798, for a Bleaching Liquor. Tried in the King's Bench, 23d December 1802, before Lord Ellenborough. The plaintiff was nonsuited.*

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The utility of the Bleaching Liquor was fully proved, and that it was not at all known or used, before the patent. A bleacher at Nottingham proved that he had used the method six years before the patent, but he kept it secret, except from his two partners and two servants. A chemist at Glasgow stated, that he had, in conversation with the patentee, two years before the patent, suggested to him to keep the lime water agitated during the process, which is an essential condition. *Lord Ellenborough*: "This is a scandalous patent, equally unfounded in law and justice; there are shameful abuses in patents, and some remedy is necessary."

Hesse against Stevenson. An action to recover back 1,800 l. paid for shares of Koops' Patent of 1801, for making Paper from Straw, &c. which shares had been sold by the Assignee of the Patentee. Tried in the Common Pleas Michaelmas 1803, before Lord Alvanley. Judgment for the Plaintiff.

Davies, p. 244.

The patentee Koops had been a bankrupt, and had not obtained his certificate at the date of his patent, nevertheless he assigned that patent to Stevenson the defendant, who (under power of an Act 41 Geo. 3, extending the benefit of that patent to 60 persons) sold to plaintiff certain shares of the patent, and received £. 1,800 for such sale. It was contended that the uncertificated bankrupt had no power to assign his patent, without consent of his creditors, and sales made under such invalid assignment being void, the money ought to be returned.

Davies.

Mr. Justice Chambre: "As the patent right is made assignable, why may it not be assigned under a commission of bankrupt?" *Lord Alvanley*: "The schemes which a bankrupt may have in his own head, before he obtains his certificate, or the fruits which he may make of such schemes, do not pass to his assignees of bankruptcy, nor could they require him to assign them over, provided that he does not carry them into effect until after he has obtained his certificate; but if he avails himself of his skill, and thereby acquires a beneficial interest, that may be the subject of assignment; the interest in the patent is of such a nature: viz. "it belongs to his creditors, and he could not assign such patent to any others." "The Act does not give any title to Koops, that he had not before it was passed; it only allows assignments to be made to any number of persons under sixty, instead of only five."

The King against Murray. A scire facias to repeal Murray's Patent of 1801, for constructing the Air Pump, and other parts of Steam Engines. Tried in the King's Bench before Lord Ellenborough, 9th July 1803. Verdict for the Crown; and the Patent was cancelled and repealed.

All those parts of the invention which were really new, and useful, and deserving of a patent, were proved to have been invented by Messrs. Boulton and Watt, and to have been practised at their manufactory, for a considerable time before the date of the patent.

Huddart against Grimshaw. An Action for infringement of Huddart's Patent, of 1793, for a new mode of making great Cables and other Cordage, so as to attain a greater degree of strength therein, by a more equal distribution of the strain upon the yarns. Tried in the King's Bench, before Lord Ellenborough, 23 December 1803. Verdict for the Patentee.

Davies, p. 265.

The invention was to make cordage with all the yarns disposed in concentric cylindrical layers, one over another; for this purpose the yarns are wound each upon a distinct bobbin, and therefrom the yarns are conducted through holes in a register plate, those holes being arranged in concentric circles around a central hole; the yarns are all brought together through a tube into one strand, after passing through the holes. That strand being turned round, and at the same time drawn forwards, draws all the yarns at once, with a screwing motion, through the tube and through the holes in the register plate, unwinding them from the several bobbins, and collecting them into one twisted strand, which is compressed into a compact cylindrical form in drawing through the tube, and in which each yarn occupies its own place, always remaining at the same distance from the centre of the strand. Each bobbin being at liberty, will allow as much yarn to unwind from it as is wanted, according to the place that yarn occupies in the strand, whether the outside, or the middle part of the cylinder.

The infringement was not proved by direct evidence; it was proved that the defendant had visited the patentee's manufactory, and seen his invention in 1799, and afterwards requested to be allowed to use the patent without premium, but that was refused; also that soon afterwards defendant ceased to make the strands of his ropes in a long rope walk, in the common way, but made them within a small space, keeping the process very secret; the ropes he sold, were, on examination and dissection, found to have the same texture as Huddart's patent ropes, all the yarns being disposed in the strand in concentric layers, so as to distribute an equal tension, and portion of the strain, upon every yarn, which is not the case in common ropes.

Lord Ellenborough: "When it is found to agree in all its qualities with a rope actually made on Huddart's plan, it is *prima facie* evidence, till the contrary is shown, that it was made upon his method," and that defendant has made use of a part of the plaintiff's invention. "The importance of that invention is proved beyond a doubt; but it is questioned whether it be a new invention,

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invention, and whether the patent embraces, as essential parts, any thing which was a prior invention communicated to the public before by Mr. Belfour, who had a patent in 1793.

" In inventions of mechanism, there are
" some materials which are common, and
" cannot be appropriated by any patent; they
" are common elementary materials to work
" within machinery; but it is the adoption of
" those materials to the execution of any particular purpose, that constitutes the invention; and if the application of them be new,
" if the combination in its nature be essentially
" new; if it be productive of a new end, and
" beneficial to the public, it is that species of
" invention which may be protected by patent; but if, prior to the date of the patent,
" any part of that which is the substance of
" the invention, has been communicated to
" the public in the specification of any other
" patent, or is part of the service of the
" country, so as to be a known thing, the
" patent cannot be maintained.

" It is required that the specification shall
" convey to the public a corresponding advantage with that of the patentee; so that
" any person who is skilled in the subject,
" looking at a specification, may be able to
" accomplish the end. If, in stating the means
" necessary to the production of the end, he
" oversteps the right, and appropriates more
" than is his own, the patent cannot be maintained. Any particular thing before in use,
" which he has applied in a new manner, so
" as to effect a new purpose, may be part of
" the new invention; but if he states that
" which of itself is not new, but old and
" known to the world, though it was unnecessary for him to do so, he has overstepped
" his right, and has included in his invention
" that which is not his invention, wherefore
" his patent would be void."

Davies, p. 299.

Smith against Dickenson. An Action for Damages for taking an undue advantage of the confidential communication of a secret Invention, and surreptitiously obtaining a Patent for the same, viz. Dickenson's Patent 1802, for a method of fixing Girth-straps to Saddles. Tried 6 December 1803 in the Common Pleas, before Lord Alvanley. Verdict for Plaintiff.

Thomas Smith invented a spring strap for a saddle, to give elasticity and play to the girths, and allow the horse to breathe freely; he intended to take a patent for it. Dickenson having had a patent in 1801 for a similar object, requested to know Smith's secret, and made a written engagement not to take any advantage of the communication, under a penalty of 1,000*l.*, whereupon Smith showed Dickenson the plan. They afterwards agreed to share the profits of the invention, and take out a patent in Smith's name. Nevertheless Dickenson took out the patent in his own name, and without Smith's knowledge or consent; but being unable to give full instructions for specifying the invention, he was obliged to ask Smith's assistance, and on Dickenson's renewal before Mr. Nicholson, (who was employed to draw the specification) of the promise, that the patent, though in Dickenson's name, should be for their joint benefit, Smith gave the requisite instructions for the specification, and it was enrolled by Dickenson.

After all, Dickenson used the patent for his own benefit, he denied by letter that it contained any thing beyond his own invention, and refused to execute any articles of partnership. Verdict for plaintiff with 300*l.* damages and 40*s.* costs; defendant, at his own cost, to assign the patent to plaintiff, whose communication the jury found to be the same invention as that specified; also that plaintiff, by giving instructions to prepare that specification, had in effect agreed to the patent being in Dickenson's name; also liberty given to plaintiff to move the Court, for a verdict for 1,000*l.*, if the Court are of opinion that the sum mentioned in the defendant's engagement was liquidated damages, and not a penalty. And liberty to defendant to move for a nonsuit, if the Court are of opinion that undue advantage had not been taken of plaintiff.

Bosanquet and
Puller's Reports,
Vol. III. p. 630.

10 February 1804. The Court of Common Pleas was moved for a nonsuit on one side, and for an increase of the verdict on the other side.

The Court were clearly of opinion, " that the word penalty, in the engagement made by the defendant, prevented the 1,000*l.* being considered as liquidated damages."

Lord Alvanley: " After the defendant had engaged to take no advantage of the communication, he entered a caveat to prevent any other person but himself from taking the patent; that of itself was an improper use of the discovery, upon which plaintiff might have brought an action, though it is uncertain what damages he could have recovered. Defendant having fraudulently obtained the patent, but being unable to specify, he tempted plaintiff by offers of advantage, to specify; and, though he agreed to do so, yet it was by a continuation of the same fraud by defendant; for as those offers were never fulfilled, the plaintiff may resort to the breach of the first agreement, of which defendant is proved guilty; he has since denied and repudiated any subsequent agreement, which was a conditional one, and the conditions have not been performed; hence the action may be maintained on the original agreement."

Mr. Justice Heath: " The action is on a subsisting agreement, which defendant broke by entering a caveat, and taking a patent in his own name. It appears to me that the first agreement was not waved by the treaty for the second agreement, which plaintiff was induced to enter into by fraud of defendant, and by promises which have been broken."

Mr. Justice Rooke: " There can be no doubt that the first agreement was broken, by defendant's entering the caveat and taking the patent in his own name, immediately after the disclosure of the invention. Before the defendant can have the plaintiff nonsuited on the ground of the second agreement, he must prove that agreement, whereas he disavows all such agreement, and insists upon his right to the invention." Verdict confirmed.

Hare

Hare against Harford and Taylor. An action to enforce payment of an Annuity granted to Hare, by Harford & Co. in consideration of his licensing them to carry on their Brewery according to Hare's Patent of 1791, for a Close Cover and Water Cistern over the brewing copper, to retain the essential oil of hops in boiling worts for beer, the water for the next brewing being heated in the cistern, by the steam. Tried 14th July 1803, in the Common Pleas, before Lord Alvanley. Verdict for the Defendant.

On the ground that the invention was similar in principle to that for which a previous patent had been granted to T. S. Wood in 1784. Hare's apparatus is now universally employed in all extensive breweries; the construction is more complete than Wood's.

Taylor against Hare. An Action to recover back £.425 paid to Hare by Plaintiff, for license under Hare's Patent of 1791, in part discharge of a bond, dated 1792; the continuance of which bond had been before determined, by the Patent being found bad. Tried in the Common Pleas, and a verdict for Plaintiff for £.425, subject to the opinion of the Court, which was a judgment for Nonsuit, thus given 20 May 1805:

Sir James Mansfield, Chief Justice: "No action like the present has ever been known. Two persons, equally innocent, made a bargain about the use of a patent right, both supposing it to be valuable. The present plaintiff agreed to pay the patentee for the use of the invention; he has had the use, and, for any thing that appears, he may have made considerable profit. The two may be considered in some measure as partners in the invention, which the plaintiff would never have thought of using, had not the privilege been transferred to him by the patentee; how then can we say that the money paid, ought to be returned?"

Mr. Justice Heath: "A plaintiff having received benefit from a thing which has afterwards been recovered from him, cannot maintain an action for the consideration originally paid. We cannot take an account here of profits. If a man lease land, and the lessee pay rent, and is afterwards evicted, shall he recover back the rent, though he has taken the fruits of the land?"

Mr. Justice Rooke was of the same opinion.

Mr. Justice Chambre: "The plaintiff has had the enjoyment of what he stipulated for; both parties have been mistaken; the defendant has thrown away his money in obtaining a patent for his own invention; not so the plaintiff, he has had the use of another person's invention for his money. In Arkwright's case no money was paid back." Judgment of Nonsuit.

This case was cited by Mr. Justice Bayley, in a trial on shipping, *Mortimer v. Heeming*, in the King's Bench, 16th May 1825. "A. obtained a patent for an invention, of which he supposed himself to be the inventor, and agreed to let B. use it, upon payment of a certain annual sum secured by bond; this sum was paid for some years, until B., discovering that A. was not the first inventor, but that it had been in public use before A. obtained his patent, brought an action for the money had and received, to recover back the amount paid; it was held that he could not recover."

Bosanquet and
Puller's Reports,
Vol. I. p. 260.

Davies, p. 307.

Barnewall and
Cresswell's Reports,
Vol IV. p. 132.

Harmer against Playne, in Chancery. An application to dissolve an injunction which had been previously issued, to restrain Defendant from violating Harmer's Patent of 1794, for a machine for Shearing or Cropping Woollen Cloth. Heard 30th June 1807. The injunction continued.

Vesey, jun.
Chancery Reports,
Vol. XIV. p. 130.

Mr. Harmer had a patent in 1787 for a machine for cropping or shearing woollen cloth. The invention came into use, and in 1794 he took another patent for improvements on his former machine. In the specification to the second patent, he described the whole machine in its improved state, without in any way distinguishing what the improvements were, or making any mention of the former patent. It was objected that this was not a good specification, as it led people to believe that they were forbidden to use every thing described in it, during the whole term of the second patent, when in fact they had a right to use the greatest part, at the expiration of the first patent. On the part of the patentee it was answered, that the patent and specification must be construed together, as one instrument, and that as the patent recited the title and date of the former patent, persons would be led to examine the former specification, which was duly enrolled, and could thereby see what they were at liberty to use, after the expiration of the first patent.

Lord Chancellor Eldon: "This injunction was granted on the grounds whereon this Court has always proceeded, when the public have permitted a reasonably long and undisputed possession of an exclusive right, under colour of a patent; for it is then thought that there is less inconvenience in granting the injunction, until the legal question can be tried, than in dissolving it, at the hazard that the patent may, in the result, prove valid; and unless the injunction were granted, any person might violate the patent, and the consequence would be, that the patentee might be ruined by litigation. The present defendant had entered into an agreement for a license to work under the patent, but that is not binding if the patent is bad, because plaintiff could not legally grant that license, and there is no consideration. As this patentee has had possession against all the world, I should act against both principle and practice if I were to dissolve the injunction before the validity of the patent is tried; that would be not only enabling the defendant to exercise a right against law, but would also be encouraging others to take the same liberty. There might be such strong doubt whether the specification was not bad in law, that the Court would put an end to the injunction, although possession of the right might be distinctly proved. I think it is difficult to support this specification. The right under the present patent will subsist until 1808, but the original machine became open to the public in 1801. Great industry appears to have been often exerted by patentees, in the invention

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East's
Term Reports,
Vol. XI. p. 101,

Davies, p. 311.

Liardet v. Johnson.

Campbell's Reports,
Vol. II. p. 294.

Davies, p. 325.

invention of some improvements, annexing them to the subject of the patent, and endeavouring to cover that, as well as the use of the improvements, during a longer period than the law allows. If the improvements give an additional value to the old machine, the public may prefer the improved machine, paying for the improvements to the old machine, without them; but the choice ought always to be left open. The second patent, of 1794, recites the patent of 1787 for the former machine, and states the invention to consist in improvements thereon; but from reading the present specification no one could collect the fact that there were two patents, one for the original machine, and another for the improvement. I doubt whether it must not appear in the specification for improvements, what are the improvements, exhibiting them so as to show that it is for them alone that the patent is granted, and not having a tendency to mislead. 'The question is, whether a patent for a machine having been duly specified, and a subsequent patent being granted for improvements, it is allowable to represent in the specification, that the latter patent was granted not for the improvements, but for the machine, carrying forwards that idea, and describing the new invention as one entire machine, not as improvements contradistinguished from the original machine.' I feel very considerable doubt; but there has been possession sufficient under this patent to make it fit to be tried, but it must be done speedily. It may be put in the shape of a case, as a question of law."

On the 28th April 1809 this case was argued in the Court of King's Bench, and the following Opinions given, respecting the specification.

Lord Ellenborough: "The difficulty is, whether this mode of making a specification is not calculated to mislead, and induce people to suppose that the term for which the new patent is granted, may preclude the use of all parts of the improved machine, for they can only tell by comparison with some other patents, what are the new, and what are the old parts of the invention. If this can be done with reference to one, why not by reference to many old patents, so as to render the investigation very complicated? It may not be necessary, in stating a specification of an improvement, to state all the former known part of the machine, but it may be sufficient to refer generally to them. As in the instance of a common watch, a patentee might say, Take a common watch, and add or alter such and such parts." When *Lord Mansfield* said, that "the meaning of the specification was, that others might be taught to do the thing for which the patent was granted," it must be understood to mean persons of reasonably competent skill in such matters.

It was argued, that, if there were a succession of patents, for several improvements, ending at different periods, it might be extremely difficult to collect, from specifications like the present, at what periods the successive inventions would come to the public. *Mr. Justice Le Blanc* said, "Suppose the specification had merely described the improvements and additional parts, must not reference still have been made to the former specification, in order to understand truly how to adapt those new parts to the old machine." *Mr. Justice Bayley* said, "The second specification being as it is, suppose the former specification to be lost, how is the public to know from the second, what parts of the whole improved machine they may use?" To the latter, the patentee's counsel (*Mr. Holroyd*) answered, that the patentee cannot be made answerable for such loss; but even in that case the public would be benefited by the present mode of specifying, because the knowledge of the whole improved machine would be preserved, which would otherwise be lost, if he had merely described the improvement by itself.

Lord Ellenborough: "I feel impressed by the observation of my brother Le Blanc, that the trouble and labour of referring to, and comparing the former specification with the second, would be fully as great, if the patentee had therein only described the precise improvements upon the former machine. Reference must often be necessarily made, in these cases, to matters of general science; or the reader must carry with him a reasonable knowledge of the subject matter, in order clearly to comprehend specifications of this nature, though intended to be fairly made."

The Court certified to the Lord Chancellor that the specification was sufficient.

Watson against Pears. An Action for Infringement of Watson's Patent, dated 10 May 1808, for Improvements in Soap-making. Tried in the King's Bench, 6 December 1809, before Lord Ellenborough. Verdict for the Defendant. In this case it was objected, that the Specification was not enrolled till the 10th of June 1808. The Judge decided, that the day on which a Patent is dated, is not to be reckoned in the time allowed by the Patent for enrolling the Specification.

The Statute of Enrolments (27 Hen. VIII. c. 16.) enacts, that enrolments shall be made within six months next after the date of the deed. In a case *Thomas v. Popham*, an indenture, bearing date 9 October 1557, was enrolled in the Chancery 21 March 1558, which was the last day of the six months, reckoning 28 days to a month, and not reckoning the day of the date. This was held to be well enrolled. In reply it was objected, that the grantor in that case was a subject, but that grants by the King are liable to a different rule of construction.

Lord Ellenborough: "It used to be held, that the words, 'from the date,' includes that day, in the computation of time; that the words, 'from the day of the date,' excludes that day. Where the time is to be from any act done, the day on which that act is done, is to be included in the reckoning. These formal distinctions have been done away, and the rule of good sense established, that the words shall be construed according to the meaning of the parties who use them. The case cited is in point, and shows that the day on which the patent bears date, is not to be reckoned. Therefore the month allowed in Watson's patent only began on the 11th of May, and included the 10th of June, on which day the specification was enrolled." A verdict was given against the patentee on other grounds.

Note.—This decision is frequently of importance to the patentees of valuable and complicated inventions, which are very difficult to organize sufficiently within the time allowed for specifying, to be able to describe them in a proper manner, so as to support the patent; an additional day will often make the difference between being obliged to specify from speculation, or from the result of an experiment.

Bainbridge

Bainbridge against Wigley. An action for Infringement of Bainbridge's Patent of 1807, for Improvements on the Flageolet, or English Flute. Tried in the King's Bench, December 1810, before Lord Ellenborough. A juror was withdrawn, and each party paid their own costs, the Plaintiff undertaking to bring no new action.

The specification stated, that by the improvement, the instrument produced notes not before produced on the old instrument; it appeared from the evidence that it was a great improvement, but only one new note was produced. Lord Ellenborough held, that this would be fatal to the patent, the consideration on which it was granted, not being truly stated. The patentee stated, that by his improvement he had given new notes, when in fact he had given but one new note.

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Dyer ex-parte in Chancery; on a petition respecting an application for a Patent, in 1812, which had been commenced previously to another application for the same object, but owing to circumstances, the progress of the first application had been delayed, and the second was in advance, so as to be likely to be sealed first.

Lord Chancellor Eldon held, that in concurrent applications for a patent for the same object, that which obtains the great seal first, will have the sole right at law. "I can see no other mode of deciding, than by awarding the patent to him who runs the quickest through the process."

Fox ex-parte in Chancery. An application for sealing a Patent, for certain Improvements in Steam Engines, notwithstanding a caveat which had been entered by another Patentee, who alleged that the plan was borrowed from his Patent. Heard before Lord Eldon, 9 December 1812. Patent granted.

Vesey & Beame's
Chancery Reports,
Vol. I. p. 67.

An affidavit was made by an engineer, that the two inventions were quite different from each other.

Lord Chancellor Eldon observed, "A man may, if he chooses, annex to his specification a picture or model descriptive of the invention; but his specification must be in itself sufficient, or it will be bad." "If the petitioners have invented improvements upon an engine, for which a patent has been granted, and those improvements cannot be used without the original engine, the petitioners could, after the expiration of that patent, make use of a patent for their improvements, though they would have no right to make use of the other's substratum before their patent for it expired; after that time the public will have a choice between the patents."

"This is a very difficult subject; but I think I am not justified in withholding this patent. I do not like to give costs in a case of this kind, because I cannot say that under the circumstances the jealousy on the other side was unreasonable."

Wood and others against Zimmer and others. An issue out of Chancery, to try if Zinck's Patent of 1812, for "a Method of making Verdigris," was a valid Patent on the 5th February 1813. Tried in the Common Pleas, 1st July 1815, before Chief Justice Gibbs. Verdict against the Patentee.

Holt's Reports
at Nisi Prius,
Vol. I. p. 58

The defendant Zimmer had agreed to purchase Zinck's Patent for 2,500*l.*, but afterwards refused to pay to plaintiff, Wood, (the assignee of Zinck, who had become bankrupt since), alleging that the patent was invalid. The verdigris was proved to be superior to the French; and that it could be made by boiling copper in oil of vitriol, as directed by the specification; but there was no mention of aqua fortis, which Zinck was accustomed to put secretly into the boiler, in order to hasten the solution; but he had kept that secret ever since. The article was made and sold before the date of the patent.

Chief Justice Gibbs: "A patentee must disclose the most beneficial manner that he possesses of carrying on the invention, with as little labour and expense as it costs himself. The price he pays for his patent is, that he will enable the public to practise in the same way, and with the same advantages. If any thing which gives an advantageous operation is concealed, the grant is void. Though this specification should enable a person to make verdigris, substantially as good, without aqua fortis, as with it, still as it would be made with more labour, the omission is a prejudicial concealment, and a breach of the terms the patentee made with the public. The objection that the article was not new at the time of the patent (because a great quantity was sold by the patentee in the course of the previous four months) is somewhat new: some things are obvious as soon as they are made public; of others, the scientific world may possess itself by analysis; some inventions almost baffle discovery; but to entitle a man to a patent, the invention must be new to the world: the public sale of that which is afterwards made the subject of a patent, though sold by the inventor only, makes the patent void." "The jury will say whether aqua fortis was used by the inventor, and whether the invention was in public sale, before the patent;" in either case, the Judge thought the patent void. The jury found both in the affirmative. Verdict for the defendants.

Manton against Parker. An Action for infringement of Manton's Patent of 1803, for an Improved Hammer for the Locks of Fowling Pieces. Tried in the Exchequer, 6th July 1814, before Lord Chief Baron Thompson. The Patentee Nonsuited.

[Davies, p. 327.

The under side of the hammer, which forms the cover of the pan, containing the priming powder, has a small prominent lip, which applies very close against the touch-hole, and is hollowed out, and perforated with a small hole, so as to let the air pass through, but not the powder; the intention being to let the air pass out of the gun-barrel, when the wadding is rammed down, but to keep the touch-hole always full of powder, in order to prevent flashing or hanging fire. It was contended, that hammers corresponding to the description in the specification, had been tried before the

patent,

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Davies, p. 333.

patent, but did not answer; also, that Manton, in his own practice, could not make them answer, without making the holes so large as to let the powder pass through, from the barrel into the pan. On a witness showing the Court, that common gunpowder procured at an adjoining shop, did so pass through the hole in the lip of one of Manton's own hammers, *The Lord Chief Baron* said, "The powder passes through the same hole as the air; it seems to me, therefore, that the utility of this invention, and the purpose of this patent wholly fail; that of itself would be an answer to this action; besides, on other parts of the case, the evidence is strong." Plaintiff nonsuited.

Joseph Manton against his brother John Manton. An Action directed by the Court of Chancery, to try if there was any violation of Joseph Manton's Patent of 1803, for an Improved Hammer, and of his Patent of 1806, for an Improvement in Double-barrelled Guns. Tried in the Common Pleas, 20th June 1815, before Lord Chief Justice Gibbs. Verdict against the Patentee.

The improvement in double-barrelled guns, consisted in fixing a grooved ruler between the two barrels, in a proper direction to form the line of sight, to point the gun to the object to be fired at.

Lord Chief Justice Gibbs: "It is necessary that the patentee should show that the invention is new, and unknown to the trade, and to the world before; that it is useful to the public; and that he has accurately explained the invention in his specification, separating that which is new, from that which is old, so as to enable a person of tolerable skill, to make the thing by means of his specification. Some men of experience, who we have heard, had never seen these inventions before the patents; *prima facie*, that is good evidence, but fifty witnesses proving that they never saw them before, would be of no avail, if one was called, who had seen and practised them. It is proved, that the mode of directing the sight in double-barrelled guns, had been practised before. Several gentlemen have proved, that the hammer with the perforated lip is a useful application, but it is also proved that such hammers were made many years ago. Verdict for the Defendant.

Forsyth against Manton, in Chancery. An application for an Injunction to prevent the violation of Forsyth's Patent of 1807, for his method of giving Fire to Artillery and all kinds of Fire Arms. Heard 15 July 1816. Application refused, from doubts of the validity of the patent.

The invention was the application of percussion power for priming artillery and fire arms, by introducing it into a hollow cylinder, communicating with the touch-hole, and inserting a moveable plug or stopper into the cylinder, so as to inclose the powder between the bottom of the cylinder, and the end of the plug; by striking a blow on the plug, the powder can be ignited, and the piece fired off; the close plug preventing the fire of the percussion power from dissipating its force.

Lord Chancellor Eldon said, "The application of these chemical combustibles to the discharge of fire-arms by percussion, is not new; and I think it would be difficult to say, that this particular method of applying percussion, to ignite such chemical combustibles, for the purpose of discharging fire-arms, is a subject for a patent. An action should be brought at law, and then an injunction may be moved for.

Forsyth against Reviere. An action for Infringement of Forsyth's Patent of 1807. Tried in the Court of King's Bench. Verdict for the Patentee.

It was held, that if several persons simultaneously discover the same thing, the publisher, or party who first communicates it to the public, under the protection of a patent, becomes the legal inventor, and is entitled to the benefits to be derived from the exclusive use of the invention.

George against Beaumont, Wackerbank & Martineau, in Chancery. An application to dissolve an Injunction previously issued, to restrain the Plaintiff from invading Constant's Patent of 1812 (assigned to Beaumont and Wackerbank), and Martineau's Patent of 1815; for methods of Refining Sugar by means of Charcoal, those parties having combined their interests under both Patents. Heard 10th August 1815. Injunction dissolved.

The injunction had been granted on the statement, that Mr. George had treated with the patentees, for the purchase of a license to practise their patent; and having under that pretext, watched the process of refining sugar by means of charcoal, in their manufactory, he afterwards put it in practice for himself, without license. It was now contended, that the refining properties of charcoal had been known before the patents, and therefore they could not be maintained.

The Lord Chancellor said, he had generally been of opinion that patentees were hardly dealt by, but he would by no means urge the right of patents beyond their lawful limits. The patent might give too extensive a power to the holders, and great inconvenience might arise from imperfect or doubtful interpretation of their rights. Whether the patents were good or not, must be determined at law, for it was only in a few special cases that the Court could properly enter on such subjects. The patents must be protected till they are found bad. The mode in which the plaintiff had obtained information, whilst affecting to treat for a license, could not be justified. If the patents should be determined good, damages might be recovered, not only by the patentees, but by the persons who had obtained licenses from them. The injunction was dissolved, and an account ordered to be kept, of the extent to which plaintiff practised the inventions, until the validity of the patents could be tried at law.

Note.—This was compromised, and no trial took place. Mr. Martineau's process of refining sugar by animal charcoal has since come into general use, at first under licenses, but afterwards the patent was generally infringed, and the patentee, being engaged in other business, abandoned it, rather than incur the expense and vexation of law proceedings against a whole trade.

Macfarlane,

Chitty, jun.
Prerogative of the
Crown, p. 182.

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Starkie's Reports,
Vol. I. p. 199.

Starkie's Reports,
Vol. I. p. 205.

Macfarlane against Price. An action for Infringement of M'Gregor and M'Farland's Patent 1808, for Improvements in the construction of Umbrellas and Parasols. Tried in the King's Bench, 20th February 1816, before Lord Ellenborough. Plaintiff Nonsuited.

Lord Ellenborough: The specification ought to state what is new, and what is old, so that a person by reading it, ought to be warned against the use of the particular invention. This specification does not say what is new and what was old, but it comprises that which is old, as well as that which is new, and it cannot be collected from the whole, in what the improvement consists.

Lord Cochrane against Smethurst. An issue directed by the Lord Chancellor to try the validity of Lord Cochrane's Patent of 1813, "for a method or methods of more completely Lighting Cities, Towns, and Villages." Tried in the King's Bench, 22d February 1816, before Mr. Justice Le Blanc. Plaintiff Nonsuited.

The invention was a lamp for lighting out of doors, the flame being inclosed within a glass-bowl or half-globe, with a vertical chimney placed exactly over the flame, to cause a draft and carry out the smoke, and also an air-pipe to introduce fresh atmospheric air, from the outside of the glass, and project it immediately upon the flame, at each side thereof, whereby a constant change of air is occasioned, to maintain the combustion. The merit and novelty of the lamp was proved, and that the defendant had adopted it from plaintiff.

Mr. Justice Le Blanc: "I am of opinion that the patent cannot be maintained; from the specification the invention appears to consist in the improvement of an old street lamp, by a new combination of parts known before. The patent is too general in its terms; it should have been for an improved street-lamp, and not for a method of lighting cities, towns and villages." Nonsuit.

The King against Cutler. A scire facias to repeal Cutler's Patent of 1815, for Improvements in Fire-Grates or Stoves. Tried in the King's Bench, June 1816, before Lord Ellenborough. Verdict for the Crown.

Starkie's Reports,
Vol. 1. p. 354.

This was a stove-grate for apartments, having a close chamber beneath the fire-place, to contain a sufficient quantity of coals for a whole day, that mass of coals forming the bottom of the fire-place: by winding up a handle whenever the fire requires fuel, all the coals in the chamber can be raised up, so as to elevate a portion thereof into the lower part of the fire-place; therefore, instead of throwing raw coals on the fire, the fuel is supplied under the fire, and the fire advances downwards, whereby all the smoke that is emitted by the raw coals below, ascends through the fire, and is consumed; the coals thus become converted into coke, before they are actually ignited.

The specification, after describing the stove, thus claimed as the invention, "that the fuel necessary for supplying the fire, shall be introduced at the lower part of the grate, in a perpendicular or oblique direction; as to the manner of performing it, that is set forth in the description and drawings."

It was proved that grates for cooking had been made before, with moveable bottoms, to be raised up by racks and pinions, and with doors to shut against the front bars, so as to conceal the fire; but those were schemes to contract or enlarge the depth of the fire-grate, according to the size of the meat to be roasted; and the doors were to shut in the heat for cooking, when the fire was not required for roasting; it was never thought, or intended, to use the doors to form chambers, which would contain a supply of fuel, that could be introduced into the fire-places from below upwards.

Lord Ellenborough was of opinion, that the principle on which those grates were constructed, was identical with the concluding terms of the specification; that the patentee, by thus summing up the extent of his invention, had confined himself to that principle, which was not new; and therefore the patent could not be supported, although the application of the principle, as described in the specification, might be new. The patent was ordered to be cancelled, and repealed.

Bovill against Moore and others. An action brought by direction of the Lord Chancellor, for Infringement of Brown's Patent of 1811 (assigned to Bovill), for "a machine for the manufacture of Bobbin Lace or Twist Net, resembling Buckinghamshire Lace, as made by hand, with Bobbin on Pillows." Tried in the Common Pleas, 1st March 1816, before Lord Chief Justice Gibbs. Verdict against the Patentee.

The machine was for making several narrow breadths of Lace, side by side. The fabric of real Buckinghamshire lace requires two systems of threads, like the warp and weft in cloth; the longitudinal threads extend lengthways of the piece, and intertwist with diagonal threads, which latter traverse the breadth obliquely, from edge to edge, and then return with an opposite obliquity, whereby the different diagonal threads, which are so traversing in opposite directions, cross each other, and their intersections form the tops and bottoms of the hexagonal meshes of the lace; the sides of those meshes being formed by the inter-twisting of the diagonal threads, with the longitudinal threads.

All the varieties of lace that could be made by machines founded upon Morris's patent of 1764, were only imitations, by knitting-work, without any diagonal threads or twisting, which are essential conditions to make lace, which will retain the figure of its meshes after washing.

The first successful machine for making the real twist lace, was Heathcoat's patent of 1809; he warped the longitudinal threads on a roller, and wound up the lace on another roller, as fast as it was made, as the warp is wound in a loom for weaving cloth, only the warp stood in a vertical plane; the weft was supplied by a very different principle from common weaving; for in lieu of a shuttle, each of the diagonal

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diagonal threads was wound upon a separate thin flat bobbin, shaped like the sheave of a pulley, and about the size of a shilling; they were all placed in a row, side by side, in proper carriages, without touching each other, thus forming as many distinct shuttles as there were threads in the warp. In the operation, the row of bobbins was put through the spaces between the upright warp threads, penetrating through the plane of the warp from front to back, and after making a small lateral movement, the bobbins were returned again through that plane, or between the vertical warp threads, from back to front; each bobbin, in so doing, passed and returned at the opposite sides of its corresponding warp thread; and by repeating that manipulation, each bobbin thread became twisted around each warp thread, so as to make the sides of a row of hexagonal meshes. The twisting being done, the bobbins were arranged in a new order in their row, by passing each one round to the other side of its neighbour, by moving sufficiently sideways. This evolution effected the mutual crossings of the diagonal threads, each one crossing over the adjoining one, so as to make the tops and bottoms of the row of hexagonal meshes. A correct shape was then given to that row of meshes, by inserting a row of pins into them, to keep them open to the proper size, whilst a succeeding row of meshes was formed, as before; by first twisting the longitudinal threads with the adjacent diagonal threads, then crossing the adjacent diagonal threads over each other, and then inserting another row of pins, to give shape to the meshes so formed.

Heathcoat's machine was applied to make wide pieces of lace net, but it was also capable

of making a row of distinct breadths, by some modifications in that evolution, whereby the bobbins were new arranged in their row, in order to effect the crossing of the diagonal threads. That was a subsequent improvement.

Brown's machine, which was began after Heathcoat's was in use, was expressly intended to make breadths of lace; it reversed and inverted Heathcoat's system of working; thus the threads wound on the distinct bobbins, formed the longitudinal threads in the lace, and the threads warped on the roller, were the diagonal threads. This variation occasioned such changes in all the mechanical movements of the machine, as rendered it very different from Heathcoat's, and its position was also inverted; but Brown adopted Heathcoat's principle of having one-half of the threads on distinct bobbins, arranged in a row, so as to pass and repass between the warp threads, in order to effect the twisting of those two sorts of threads together. The crossing of the upright warp threads, each one over its neighbour, was effected in Brown's, by a piece of machinery which had been invented by Morris in 1781, in an attempted machine, which failed for want of introducing diagonal threads; but Brown, in adopting Morris's abortive contrivance, added a new one of his own, which caused the warp threads, after being so crossed, to continue to traverse obliquely all across the breadth in opposite directions, and to return, on arriving at the edges; that was effected by giving the horizontal roller on which the threads were warped, an additional rotatory motion, about an imaginary centre, at the middle of its length, so that the two ends of the roller went round in a horizontal circle.

Brown's specification had many drawings, which described all the separate parts of which the machine was composed, and also represented the whole machine put together, but it was difficult to understand how some parts were to be put together in the machine, which was exceedingly complex. There was also an omission of the means which the patentee used, to cause the diagonal threads to return, when they arrived at the edges of each breadth; for, by following the specification literally, the diagonal threads of each breadth would have been carried obliquely onwards into the adjoining breadths, so as to entangle therewith. The specification did not point out any distinctive character of the invention, but said, "my invention consists as represented in the drawings," and then described all the parts of the machine.

The infringement of Brown's patent was proved by two engineers, who had been sent, by order of the Lord Chancellor, to examine defendant's machinery.

It was contended, that the circumstance of the warp threads from the roller, becoming diagonal, constituted a new invention; for in twisting the two sorts of threads together, the warp thread was enabled to be the actor, and the bobbin thread was acted upon; and that thereby the lace was made with better selvages than Heathcoat's; that although Heathcoat had commenced law proceedings against Brown, for infringement of his patent of 1809, he had never ventured to come to a trial. On the other hand, it was contended, that the specification claimed the whole machine; when, in fact, the bobbins and their movements, by which the twisting was effected, were Heathcoat's, and also part of the machinery, by which the crossing was effected, was Morris's; also, that the specification was defective in instructions how to make the proper selvages, to the distinct breadths which was the great object of the patentee, and his only claim to superiority over Heathcoat's machine.

Lord Chief Justice Gibbs: The patentee must show that he has performed all the conditions upon which the privilege was granted to him, and particularly, that he has described the mode of manufacture, so as to enable any competent person to make it, after his term is expired. In his specification he is bound to confine himself to that which is his invention; and if he has exceeded the limit of what he has invented, and for which he is entitled to the sole privilege, though there may be no other objection to his patent, that will overturn it. According to this specification, whatever is contained in the drawings annexed to it, is claimed as new invention, and if it is all new, he is entitled to maintain an action against any one who shall practise any part of what is represented.

It is not disputed that the machine is new, as far as respects a certain part of the manufacture, nor that the machine is useful. The evidence is uniform, that with the exception of some slight difficulties, a workman of common skill would be able to make the machine, by applying a great deal of attention to it (which so complicated a machine, however described, must necessarily require), and bringing a competent degree of skill. The specification ought also to enable a workman to use the machine to the extent most beneficial, within the knowledge of the patentee at the time; without reserving to himself any more beneficial way of working. This specification does not point out certain precautions which are actually used, in all these machines, and without which there would be danger of the diagonal threads of each breadth, entangling with those of the adjoining breadth; but it appears that that entanglement might be corrected as it occurred, if the workmen exercised a competent degree of attention. If Mr. Brown has since discovered and applied an improvement for that purpose, his patent will not be affected by his using his own machine in that improved state, for he will have added to the original merit of his invention, the further merit of using

using it more beneficially. But if at the time when he obtained his patent he was apprised of such more beneficial mode, and did not communicate it to the public, that would be a fraudulent concealment, which will render his patent void: it appears that no machines have been used by him, without such improvement.

The evidence has shown, that the originality of the machine, is in the mode of obtaining the longitudinal threads from the distinct bobbins, and the diagonal threads from a warp roller, which roller, besides turning round on its own axis to allow the thread to unroll from off it, has another revolving motion, around the middle of its length; so that the two ends of the roller describe a horizontal circle, in order to disperse its threads diagonally over the breadth of the lace, in two sets, which traverse that breadth with opposite obliquities. But although the invention may be beneficial, and in that respect new, the specification will be bad, if it states him to have invented that which was known before, because that affects to give him a larger privilege, than could legally be granted to him. The novelty of the contrivance by which the warped threads are made diagonal, is admitted, excepting the machinery for crossing those threads, which was borrowed from Morris; but the evidence states, that all which precedes the operation of crossing the threads, had been previously practised, by substantially the same means, in Heathcoat's machine, the principle being the same in effect.

In the case of *Boulton & Watt v. Bull*, the infringement by Bull was an engine, which, on the first view, had not the least resemblance to Watt's, for the head was placed where the feet were looked for; but he had taken the principle, which acted as well one way upwards as the other; and when Bull's engine was set upright, it was exactly like Watt's. So Brown's machine makes lace at the bottom of the machine, by a downward operation, and Heathcoat's made lace at the top of the machine, by an upward operation, which must be considered as the same in point of invention. I think I may state, that all that precedes the crossing of the diagonal threads is old, whereas he has stated it as part of his invention; and also that some of the parts by which those threads are crossed are old. Brown's patent ought to have been only for an improvement; and certainly his specification should have pointed out those parts which were of his invention, and to which alone his privilege applied. If a combination of parts, forming a certain portion of Brown's machine, existed before, and he took up his combinations at that point, and went on combining beyond that, he has no right to the former combinations, and his specification, claiming the whole machine as his invention, is bad. But if he had the merit of inventing the combination of all the parts from the beginning, his specification is good.

The jury thought the defect in the specification "might be inadvertent, and not fraudulent;" the Judge observed, "if he knew it, and did not state it in his specification, he must answer for his inadvertence." They then found, that "the combination of the parts up to the crossing of the threads, is not new; that the threads then taking a new direction, which is the most valuable part to the plaintiff, is a new invention; but it is nothing more than an improvement."

On the 3d May 1816, a motion was made for a new trial, but it was refused.

Lord Chief Justice Gibbs: Some confusion has been made between a new machine for making lace, and making lace on a new method, by a machine partly old and partly new. The present patent grants the sole use of the machine, and whoever imitates it, either in part, or in the whole, is subject to an action from the patentee. If it had been a new invention from beginning to end, and Heathcoat had afterwards made the machine described in his specification of 1809, is there any doubt, but that such machine would have been an imitation of part of Brown's invention? The evidence proved that up to a certain point, Brown's was an imitation of Heathcoat's. The drawings to Brown's specification are divided into different sections, each containing a portion of the machine, in a different stage of the progress of making it; one of those sections contain the principle of distinct bobbins, to pass and repass between the perpendicular threads of the warp, in order to effect the twisting; it was proved that the whole of that section existed in Heathcoat's machine; and that a combination carried no farther than that, was a useful step of invention towards a complete machine.

Mr. Justice Dallas: The law is quite clear, that if an invention be only an addition to an old invention, the patent must be for that addition only; as in *Jessop's* case of a particular movement in a watch. The question is, whether Brown's machine be a new invention *in toto*, or from a certain point only. The witnesses said, that if Heathcoat's machine had been made after Brown's, it would have been an infringement on Brown's patent; such patent therefore, to the extent contended for, must be void.

Mr. Justice Park: The law was most correctly stated by his lordship to the jury; it is not new law; for in the *King v. Else*, Mr. Justice Buller held, that where the invention consisted of an addition, or improvement only, a patent for the whole machine was void. In the present case, the jury have found, that up to a certain point, the machine acts like the former one, and that the invention is only an improvement. The verdict was confirmed against the patentee.

Newbery against James and others in Chancery. An application to dissolve an Injunction previously issued, to restrain Defendants from making or selling, and from disclosing the composition of Fever Powders, for which Dr. James (grandfather of one of the defendants) had a Patent in 1747; also of the Analeptic Pills, for which no Patent had been obtained. Heard 27 March 1816, before Lord Eldon. Injunction dissolved.

Dr. James, the grandfather of defendant, made agreements with Mr. Newbery, the father of plaintiff, in 1747 and 1755, that Dr. James, his executors, &c. should exclusively prepare those medicines for Mr. Newbery, his executors, &c. who should have the exclusive sale. Those agreements were to continue for an indefinite time, and had been acted upon till lately; when, in consequence of an alleged violation, an injunction was granted as to the sale only of the medicines; and this was an application to remove the injunction.

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Marshall's Reports,
II. 211.

Merivale's
Cases in Chancery,
Vol. II. p. 446.

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Lord Chancellor Eldon: "How can the specific performance of the agreements be decreed? If the composition of the medicines is a secret, how can this court enforce any order that it might make? If it is not a secret, what is the ground for interfering? The patent for the fever powder is long expired, and it is required to enforce an agreement, by which the parties (independently of that patent) covenanted not to sell the patent article, except through each others hands. The specification ought to enable all the world now to use the invention; and if the preparation of the analeptic pills were a secret, what signified an injunction? For unless a disclosure were made, the court possesses no means of determining, on any occasion, whether it had been violated or not. The party who comes to complain of a breach of injunction, must first show that it has been violated. The injunction must be dissolved; the defendants to keep an account of what they sell, whilst the right is tried at law."

Note.—It was a misstatement to the court, that there had been no patent obtained for the *Analeptic Pills*; Dr. James had a patent for them in 1774; but the specification is not intelligibly worded.

Heathcoat-ex parte in Chancery. An opposition to sealing a Patent to Lacy, for a machine for making Twist Lace or Bobbin Net, to be worked by Steam power; on the ground, that the proposed Patent did not require the Specification to be enrolled, until fifteen months after the date. Heard 25 July 1816, before Lord Eldon. Seal refused.

It was stated that the patentee intended to apply to parliament, as in Lee's case (53 Geo. 3, c. 179) to withhold the specification from public inspection, in order that the invention might not be sent abroad, and that fifteen months was necessary to make that application to parliament.

The Lord Chancellor Eldon said he could not put the seal to a patent which allowed fifteen months for enrolling the specification; that indulgence had been rarely granted. Mr. Lee's was a very peculiar case, being thought a most important discovery, and in time of war. If the present could be made out to be as beneficial, it would be doubtful whether a secret specification would be allowed; for his lordship was of opinion, that the legislature would pause a long time before they passed such an act in future; and he would venture to say, Mr. Lacy would not procure one. He could not establish a new principle, merely to prevent the French from smuggling; nor put the great seal to such a patent, without seeing the specification, for it might turn out good for nothing. The patent could not pass without the responsibility of the great seal, and if he sealed it, he might be called upon to give an account in parliament, why he had extended to this individual a particular privilege, which is contrary to the general policy of the law. He could not, in justice to the King's subjects, seal this patent, merely because it was a manufacture which other countries might wish to get.

Note.—On this refusal, a new patent was made out, with six months for enrolling; it was sealed 30 September 1816. The invention was afterwards practised to a considerable extent, but did not succeed, and has been abandoned in favour of other machines having the same object.

Walker against Congreve in Chancery. An application for enforcing an Injunction previously issued against violating Walker's Patent of 1810, for Barrels for preserving and conveying Gunpowder. Heard 27 July 1816.

The Lord Chancellor Eldon said, "An injunction may be issued against violation of a patent which has been obtained with all the necessary forms, although on examination the patent may be found improper." Defendant might show reasons for dissolving the injunction, but was bound by it, whilst it was in force, and would commit a contempt in disobeying it. So an injunction might be issued against a public servant, who, as such, was not liable to the consequences of a private suit, and therefore an injunction ought not to have been issued; still the authority of the court must be respected, and the injunction dissolved by the court, not broken by the party against whom it issued. In cases of penalties for contempt, all alleviating circumstances were matters for consideration, and he would hear the case before deciding on the question of contempt.

From that hearing, it appeared very doubtful to his lordship whether the patent had really been infringed, or could be maintained; the powder-barrels made by defendant, which formed the subject of complaint, being as much like some old ones, made years before, as they were like those described in the specification. His lordship said, that the injunction must be dissolved, and an account kept of the articles made by defendant, until the validity of the right could be tried at law. "The injunction had been granted upon the statement, that it was a new invention, and that the defendant, in addition to making barrels for the public service, had also supplied East India ships. After the injunction was made, it should have been observed, till dissolved by the court. "I will treat government here as I would any other suitor of the court; and as there are grounds "for believing the injunction violated, the defendant must pay the costs of this application."

J. Williams against J. T. B. Williams, his Wife and another, in Chancery. An application to dissolve an Injunction previously issued by the Vice-Chancellor, to restrain the Defendants from divulging the secret composition of certain Medicines for curing Diseases in the Eye, and from preparing or vending those medicines. Heard 6 August 1817. Injunction dissolved.

The plaintiff had stated that he was the sole owner of the recipes of the medicine, which he had made and sold for many years; that he communicated the secret to his son, the defendant, and had put him in possession of his shop, and stock of medicines, with the intention of taking him into partnership when of age, under certain conditions; but those conditions not being fulfilled, and the son threatening to expose the secret, the father applied to the court, and obtained the injunction to restrain defendants from proceeding.—The son denied that it was any secret to him, when the communication was made by his father, for that he had been instructed in it in early life, by his mother, who had derived the secret from another, and had communicated it to her husband, the plaintiff.

Lord

Lord Chancellor Eldon. "The court was regular in granting the injunction, so far as to restrain the son from selling the articles put into his possession by his father, in the confidence of a treaty for his becoming a partner when of age; for if that did not take place, he was bound to return the articles. But so far as the injunction goes to restrain the son from communicating the secret, upon general principles, I do not think the court ought to struggle to protect this sort of secret in medicine. The court is bound to protect patentees, but that is because they have published their secrets. But whether in the exercise of its jurisdiction, to decree the specific performance of agreements, the court ought to restrain a party from divulging a secret discovery, that he has promised to keep, is a question that would require very great consideration. In this case it is denied that there is any secret, and there appears no ground to support the injunction."

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Canham against Jones, in Chancery. An application to the Vice Chancellor, to restrain Defendant from making and selling a Medicine called Velno's Vegetable Syrup, of which Plaintiff claimed to be the sole Proprietor. Heard before Sir Thomas Plumer, who refused the application, on the ground that the Plaintiff had no exclusive property in the Medicine.

Vesey and Beame's
Chancery Reports,
Vol. II. p. 221.

Isaac Swainson had purchased the secret or recipe for preparing the medicine for £. 600, thirty years before his death, and he continued all that time the sole proprietor and maker; by his will he bequeathed it to plaintiff, who continued to make and sell the same preparation. Defendant had lately begun to sell a medicine, under the same name.

Sir Thomas Plumer, Vice-Chancellor. It is an erroneous notion, that there is an exclusive property now subsisting in this medicine, or that Swainson having purchased the secret, and disposed of it by will, had a power to give the plaintiff an exclusive right of sale. If such a claim of monopoly could be maintained without any limitation of time, it would be a much better right than that of a patentee. Nor do the acts of the defendant fall within the cases in which the court has restrained a fraudulent attempt by one man to invade another's property, by representing himself and his trade or productions, to be that other person's, in order to appropriate the benefit of a valuable interest in the nature of good will, consisting in the character of the trade or productions established by the individual merit of another.

The King against Metcalf. A *scire facias* to repeal *Metcalf's Patent* of 1816, for a Tapered Hair or Head Brush. Tried in the King's Bench before Lord Ellenborough, after Michaelmas Term 1817. Verdict for the Crown.

Starkie's
Reports of Cases at
Nisi Prius,
Vol. II. p. 249.

The specification directed hairs or bristles of the lengths of an inch, and of an inch and a quarter, to be mixed up together, in each of the clusters, which is afterwards to be doubled, and inserted into a hole in the stock of the brush, and fastened therein by a brass wire, whereby the ends of the bristles in each cluster will be of unequal lengths, instead of being all cut down to the same length; as was before done for hair brushes, the same as for clothes brushes, and other brushes.

Lord Ellenborough. "Tapering means gradually converging to a point; according to the specification the bristles would be of unequal length, but there would be no tapering. If that word be used in its general sense, the description is defective; if the term has, by usage of trade, a different meaning, it may be received in its perverted sense; but I cannot hold out any prospect that the difficulty arising from the grammatical consideration can be removed." After some further evidence, which did not remove the difficulty, his lordship advised the jury to find that it was not a tapering, but only an unequal brush. Verdict for the Crown. Motion was made next term for a new trial, but was refused.

Metcalf's hair-brushes, with the central bristles of each cluster projecting out beyond the others around the same cluster, have since come into general use; they penetrate the hair much better than those with all the bristles of an equal length.

Hill against Thompson and Forman, in Chancery. An application to dissolve an Injunction previously granted to restrain Defendants from violating Hill's Patent of 1814, for Improvements in the Smelting and Working of Iron. Heard 24 April 1817. Injunction dissolved.

Merivale's
Chancery Reports,
Vol. III. p. 622.

Lord Chancellor Eldon: When an injunction is applied for ex-parte, on the ground of violation of a patent right, it is incumbent on the applicant to make affidavit, that at the time of application, he is, in his belief, the original inventor; for although he might honestly have sworn to that effect when he applied for his patent, yet information may have afterwards been communicated, sufficient to convince him, that he had been under a mistake.

Where there has been an exclusive possession of some duration, under a patent right, the court will interpose its injunction, without putting the party previously to establish the validity of his patent at law. But where the patent is but recent, and it is contended that the patent is not good, the court will not, from its own notions, act upon the presumed validity or invalidity of the patent; but will require the patentee to establish the validity of his patent in a court of law, before it will grant an injunction. In this case it cannot be said that there has been such a possession, or enjoyment under the patent, as ought to induce the court to continue the injunction, until the validity has been tried at law. The injunction was dissolved, but an account was ordered to be kept of the iron made with slags by defendants according to the method in the specification.

Appendix (B.)

Papers
delivered in by
John Farey, Esq.
8 June 1829.

Holt's Reports,
Nisi Prius,
Vol. I. p. 636.

Taunton's Reports,
Vol. VIII. p. 375.

Bayley Moore's
Reports,
Vol. II. 448.

Hill against Thompson and Forman. An action directed by the Lord Chancellor as above, to try the validity of Hill's Patent of 1814, for Improvements in the Smelting and Working of Iron. Tried in the Common Pleas, at Westminster, after Michaelmas 1817, before Mr. Justice Dallas. Verdict for the Patentee; but a Nonsuit was afterwards entered.

The invention was for extracting iron from slags and scoria, which were formerly useless and thrown away as refuse. This was effected by smelting such slags in mixture with certain proportions of limestone, and mine rubbish, or the substance in which iron stones are usually found. Another part of the invention was, the use and application of lime to iron, during its treatment in the furnaces subsequently to the operation of the blast furnace, in order to prevent the quality of cold-short in the iron, that is, brittleness when cold. It was proved that the processes were valuable improvements; but that slags and mine rubbish had been occasionally smelted together before; and also, that lime had been used to prevent cold-short. It was contended, that the mere regulation of principles known before, and practised, would not support the patent; and also, that its title was too loose and general.

Mr. Justice Dallas left it to the jury to say, whether the plaintiff had made out the novelty of the improvements; viz. the conversion of slags into good bar iron, and the prevention of the quality called cold-short by the application of lime. They found for the plaintiff, one shilling damages.

On the 15th December 1817 another application was made to the Court of Chancery, in consequence of the above Verdict, to revive the Injunction; but it was deferred by the Lord Chancellor until the result of an application to the Court of Common Pleas, for a new Trial, should be known.

The Lord Chancellor Eldon: After a trial at law, if the patentee is successful, he may apply here to revive the injunction; or else the other party may come before this court, and say, I have displaced all his pretensions, and am entitled to have my costs and expenses of being brought here upon allegation of right, which cannot be supported. But in this case I see enough of difficulty and uncertainty in the specification, and enough of apparent repugnance between the specification and the patent itself, that I cannot take it for granted, that no argument can prevail upon the court of law, to let the question be reconsidered by a new trial; hence it must stand over till the result of the intended application for a new trial is known, an account of the iron made by defendants being taken in the mean time as before.

The words used by the Lord Chancellor on this occasion, respecting what is required in a specification, were cited by Mr. Justice Best on the trial *Brunton v. Hawkes* in 1821.

On the 1st June 1818, the Court of Common Pleas heard the arguments for a Nonsuit, or a new Trial. A judgment of Nonsuit was entered.

Mr. Justice Dallas delivered the judgment of the court. It is not contended that this is a patent for introducing into use, any one of the articles, slags, mine rubbish, or lime, taken singly, but that it is for combinations and proportions, producing a new effect, by a series of processes unknown before. A slight departure from the specification for the purpose of evasion only, would be a fraud upon the patent; but from the evidence, it appeared that the defendant's mode of working was very materially different from the specification; and our opinion is, that, considering the evidence with reference to the peculiar nature of the patent, the infringement is not proved.

"Every patent must stand either on the ground of an improvement invented, or on the ground of the discovery of something altogether new, and the patent must distinguish itself accordingly. If it is taken out for discovery, when the alleged discovery is merely an addition or improvement, it will be altogether void. The grounds of novelty and discovery, on which this patent must stand, are three. If the discovery claimed were known and used before, the patent is void. I mean to distinguish between the terms novelty and discovery; for it is not enough to have discovered what was unknown to others before, if the discovery be confined to the knowledge of the party having made it; but it must have been communicated more or less to others, or it must have been more or less made use of, to constitute previous discovery, as applied to subjects of this sort.

"The two cases of Dollond and of Tennant stand contrasted to illustrate this distinction. In Dollond's case the question was, who was the

true inventor, within the meaning of the statute? Hall had made the discovery before in his closet, but never made it public, and on this ground Dollond's patent was confirmed. In Tennant's case a bleacher had used the invention before, but had kept it secret, except from his two partners and two servants; the basis of the improvement had also been previously suggested to Tennant by a chemist, in conversation. Under these circumstances, he was not deemed to be the inventor, and was nonsuited.

"In Arkwright's case, the idea of drawing out the fibres of cotton between rollers, had been communicated to him by a man, whom he employed in consequence, to make models for him, before the patent; also the crank and comb, for stripping the cotton off the carding cylinder had been used before. Mr. Justice Buller was of opinion, that although there might have been a general ignorance of these improvements at the time of the patent, the previous knowledge and use by a few, rendered the patent void."

In the present case there is evidence, stating that the invention is a combination of processes known before separately, but in combination new, and producing a beneficial result; but this is only negative evidence, which merely proves, that those particular witnesses did not know of the method before; and, on the other hand, not only knowledge, but extensive use has been proved, of slags, mine rubbish and lime, as used in various ways; hence there is positive testimony against negative, leaving a result of perfect consistency.

As to the specified combination and proportions of slags, and mine rubbish, and lime, considered with a view to utility, the defendants in their working have varied in combination, and departed from

from the proportions. If the specific combination may be materially departed from, what is there beyond general combination in this patent, which professes to be precise and specific in appointment and application. The use of lime to prevent cold-short is claimed as an improvement, and nothing is said of any previous use, of which this proposed use is averred to be an improvement; but the specification says, "I have discovered that the addition of lime will prevent the quality called cold-short," which, with what follows, is a claim of discovery in its most extensive sense. A book published in 1807 was produced, and negatives the novelty of the alleged discovery, and it was proved to have been practised years ago, as far as the general application of lime, without reference to specific apportionment.

If any part of the alleged discovery, being a material part, fail (the discovery in its entirety forming one entire consideration), the patent is altogether void. In every view of the subject, the claim to novelty fails, not only virtually and technically, as the patent and specification are framed, but in effect and substance, and in the broadest and most enlarged view of the subject.

At the time of the trial, the utility of the alleged discovery being admitted, the fairness of the specification established, and the publicity afforded by the patent, compared with the partial and previous limited use, giving to the public, as it appeared to me, all but the benefit of actual and original discovery, constituted a case so far favourable to the patentee; but looking to the strictness with which, in point of discovery, patents must be construed, looking to the decisions in cases of the nearest analogy, and to the peculiar nature of this case, we feel bound to decide against the originality of that which is claimed by the patentee as new. On both grounds, therefore, that no infringement has been proved, and that the invention is not new, we are of opinion that a nonsuit must be entered. An application was afterwards made, to direct a new trial, instead of the nonsuit, but it was refused.

This case was cited by Lord Chief Justice Abbott on the trial of *Brunton v. Hawkes*, in 1821; also by Mr. Justice Best, as a patent which was set aside for claiming too much.

Appendix (B.)

Papers
delivered in by
John Farey, Esq.
8 June 1829.

The King against Wheeler. A scire facias to repeal Wheeler's Patent of 1817, for "a New or Improved Method of Drying and Preparing Malt." Tried in the King's Bench after Michaelmas 1818, before Chief Justice Abbott. Verdict for the Crown. The patent cancelled and repealed.

Barnewall and
Alderson's Reports,
Vol. II. p. 345.

The Judge thought, that "the title of the patent showed, that it was obtained for a different thing than that stated in the specification; the patent being for preparing malt, which must mean making it from barley, whereas the specification appeared to be for drying malt already made." It was also defective, in not stating the purposes to which the article when prepared, was to be applied, (viz. colouring beer and porter,) nor in describing the process with sufficient precision. These questions arising upon written instruments, and being therefore properly a question of law, the Judge directed a verdict for the Crown.

Motion being made the next term for a new trial, Chief Justice Abbott gave the opinion of the court, viz. for himself, Mr. Justice Bayley and Mr. Justice Holroyd, in February 1819.

"The language in which the supposed invention is described in a patent, is that of the patentee himself; he represents to the Crown that he has invented the thing, and that he is the first and sole inventor; the Crown, yielding to his representation, and being willing to encourage inventions, that may be for the public good, grants him the sole privilege for a time, under specified conditions. If the patentee has not invented the thing of which he represented himself to be the inventor, the consideration of the grant fails, and it becomes void, even if he has invented some other thing, which, upon a due representation thereof, would have entitled him to a grant. The word 'manufactures,' in the statute 21 James I. has been generally understood to denote either a thing made, which is useful for its own sake, and vendible as such; as a medicine, a stove, a telescope, &c. or to mean an engine or instrument, or some part of an engine or instrument, to be employed either in the making of some previously known article, or in some useful purpose, as a stocking-frame, or a steam-engine for raising water from mines: or it may perhaps extend also to a new process to be carried on by known implements, or elements, acting upon known substances, and ultimately producing some other known substance, but producing it in a cheaper or more expeditious manner, or of a better and more useful kind. But no merely

philosophical or abstract principle can answer to the word manufactures. Something of a corporeal and substantive nature, that can be made by man, from the matters subjected to his art and skill; or at least some new mode of employing practically his art and skill, is requisite to satisfy that word. He who applies for a patent, may represent himself to be the inventor of some new engine, or instrument, or of a new method of accomplishing the object which is to be accomplished by that new engine or instrument. Thus Mr. Watt represented himself to be the inventor of a new method of lessening the consumption of steam in fire-engines; and by his specification, described certain parts to be used in the construction of fire-engines. Or supposing a new process to be the lawful subject of a patent, he may represent himself to be the inventor of a new process, in which case the word 'method,' may be properly used, as synonymous with process. The language of the patent may be explained and reduced to certainty by the specification; but the patent must not represent him to be the inventor of one thing, and the specification show him to be the inventor of another; because perhaps, if he had represented himself the inventor of that other, it might have been well known that the thing was of no use, or was in common use, and he might not have obtained the grant."

The patentee, Wheeler, represented himself to be the inventor "of a New or Improved Method of Drying and Preparing Malt." Malt was an article of common use, and prepared by a process, of which drying was one of the last stages; we must suppose, by reading the patent, that he had invented some new process of preparing, or drying, this old article; but looking at the specification, we find he claims a method by a second and additional process, and a high degree of heat of giving

Appendix (B.)

Papers
delivered in by
John Farey, Esq.
8 June 1829.

to malt, when previously prepared, some qualities which it did not possess before, or only in a slight degree, viz. solubility in water, and colouring that liquor, which last is the object in view. "We think the invention mentioned in this specification, entirely different from that mentioned in the patent." If he had represented himself to be the inventor of a method of preparing malt, for the purpose of colouring beer and porter, every one reading the specification, would understand that the malt so prepared, was not intended for the common purpose of brewing beer, but was intended for colouring the liquor, and to be used in addition to common malt. Neither has he described any certain or precise process, which, admitting that there may be a patent for a process only, ought unquestionably to be done. Verdict confirmed. The patent ordered to be repealed.

Wood against Cockerell. An application to the Lord Chancellor to restrain the Defendants from violating Wood's Patent of 1815, for Spinning Machines; heard 24 August 1819. The application was refused; the patent right being doubtful, it was left to the chance of being established by verdict of a Jury, if the Patentee chose to proceed at law.

Bloxam and another, assignees of H. and S. Fourdrinier, bankrupts, against Elliot. An action for infringement of Gamble's patents of 1801 and 1803, for a Machine for making Paper, the terms of which were extended by Act 47 Geo. III. Tried in the King's Bench in 1819. Verdict for the Patentee. See further trials, *Bloxam v. Elsee*, in 1825 and 1827.

Brunton against Hawkes and Co. An Issue, directed by the Lord Chancellor, to try the validity of Brunton's Patent of 1813, for Improvements in the construction of Ships Anchors and Windlasses, and Chain Cables or Moorings. Tried in the King's Bench, after Easter Term, 25 May 1820, before Lord Chief Justice Abbott. Verdict for the Patentee; but a new trial was afterwards granted, on the judgment of the Court, that the Patent was void; consequently no further proceedings took place.

The infringement was upon the chain cable, of which the great utility and security to shipping was fully proved. The first chain cables were made by Captain Brown, with twisted links, a wrought-iron stay being fixed across the middle of the opening of each link, to keep them from collapsing. The links of Brunton's chain cables were not twisted, but were made in the strongest form, and the stays across the links were made of cast-iron, with broad ends adapted to the sides of the link, and embracing them. This kind of link had come into general use for chain cables, in place of Brown's, who himself had also adopted Brunton's links.

It was contended, that Brunton's link was not a new invention; also, that the anchor was not a new invention; and that the specification was defective in not giving any dimensions for the stay across the link, for it was only represented in the drawing, which is not an instrument in writing, as directed by the patent. The Court over-ruled this objection, for "if a drawing or figure will enable a workman of competent skill to construct the improvement, it is as good as any written description." The jury found, that the specification was sufficient, that the chain cable, and the anchor, were both new and useful, and that the defendants had infringed the plaintiff's chain cable. Damages one shilling. The novelty of the windlass was not disputed.

On a Motion being afterwards made for a new trial, it was argued before Easter Term 1821, and a new trial granted, on the ground that the Patent was void, because the Anchor was not a new invention.

Lord Chief Justice Abbott: It is with great reluctance, that my mind has at length come to a conclusion, which (as far as my judgment goes) will have the effect of avoiding this patent. It appeared in evidence, that the mode of making chain cables and anchors, introduced by the plaintiff into general use, is highly beneficial to the public, and I wish he could sustain his patent. I feel compelled to say, that the anchor is not new, and that the whole patent is therefore void.

The shank of the anchor is united to the two arms in the same manner as the handle is united to the head of a pick-axe; and that mode of union has been before used, to affix the shanks to the heads of mushroom anchors, and also adze anchors. A patent for a machine, each part of which was in use before, but in which the combination of the different parts is new, and a new result thereby produced, is good; because there is novelty in the construction; but in this case, ships anchors are commonly made of the shank and two arms, united in three pieces; plaintiff forms the two arms in one piece, with a hole through them, to receive the end of the shank, which is put through, and the end rivetted. If the union of those two pieces had been effected in a mode unknown before, as applied in any degree to a similar purpose, I should have thought it a good patent, but unfortunately it was known and practised before. A patent cannot be maintained for uniting two parts instead of three, where the union is effected by a mode known before for a similar purpose. If the patent had been for this anchor alone, I should have had no hesitation in declaring it bad.

As to the chain cable, I think the combination of a link of that particular form, with the stay of the form which the plaintiff uses, although the form of the link might have been known before, is so far new and beneficial as to sustain a patent, if it had been for that alone; but as one of the articles is not new, the question arises whether any part of the patent can be sustained.

A patent cannot extend beyond the consideration of the grant; the king could not, in consideration of a new invention in one article, grant a patent for that new article and another which was not new. If a party, by representing to the Crown that he has discovered improvements in three things, obtains a patent for the three, and in the result, it turns out that there is no novelty in one of them,

them, can he sustain his patent? The case of *Hill v. Thompson* is decisive; Hill's patent was for certain improvements in smelting and working iron. The improvement in smelting iron, was obtaining bar iron from the slag which had been before thrown away as useless. The improvement in working iron, was the application of lime in certain stages of the process, to cure a disease common to all iron, not merely to that which was to be obtained by the first improvement. It was proved, that the latter was not new, and the Court of Common Pleas held, that admitting there was novelty in one, yet as there was no novelty in the other, the patent was void.

The only difference between that case and the present is, that Brunton, instead of representing that he had made certain improvements, stated what they were applicable to; but he claims the merit of having invented three, and the patent was granted upon consideration of the entirety of the improvement of the three; and if there is no novelty in one, the consideration fails in the whole, and the patentee is not entitled to the benefit of the other. There must therefore be a new trial.

Mr. Justice Bayley: I think there ought to be a new trial. I have no doubt, that if a patent be bad as to part, it is bad as to the whole. When a patent is taken out for several things, the entire discovery of them all, is the consideration on which the grant is made; that consideration is entire; and if it fails in any part, it fails *in toto*. If every part is new, it is a matter of favour in the Crown to make the grant; and it may be, that the discovery of three things together may form the proper subject for a patent, although each *per se* would not; therefore, if any part of the consideration fails, the patent is void *in toto*.

If the present patent had been for the chain cable only, I think it would have been good. The improvement in the link is in giving it such a form as will cause the force of the strain to operate end-ways of the iron of which the link is composed, and applying a bar or stay across the opening, to keep the sides apart, that stay being without the defect of those previously used, which were pointed at the ends, and inserted into holes in the sides of the link; but Brunton's are broad at the ends, and lap round the iron, instead of penetrating into it.

The improvement in ships anchors is making the two arms in one piece (instead of in two distinct pieces each to be welded separately to the shank) a hole being left through the middle of one piece, which forms the two arms, to receive the end of the shank. I think a patent cannot be maintained for making in one entire piece that which was before made in two pieces; and plaintiff's mode of uniting the shank to the one piece was used in mushroom anchors and adze anchors; and being so like that used in a pick-axe and hammer, I do not think the mere introducing the shank of the anchor, (which may be called the handle) in so similar a mode, is an invention for which a patent can be sustained. The mushroom anchor and adze anchors, though used as mooring anchors, and not carried with ships, are still ships anchors, and the analogy between them and the plaintiff's is so close, that it does not appear to me that this discovery can be considered so far new, as to be proper ground for a patent; it is nothing more than making in one piece what was before made in two, and introducing the shank into this kind of anchor in the way a handle is introduced into a pick-axe. I think the patent is wholly void, and that there must be a new trial.

Mr. Justice Best: I am of the same opinion. In the case of *Hill v. Thompson*, the Court of Common Pleas, with great reluctance, came to the conclusion, that a patent taken out too large, is void, not only for the excess, but altogether. Respecting this case, the *Lord Chancellor* had previously said: "The Judge, Mr. Justice Dallas, in his direction to the jury, stated, as the law on patents, that the invention must be novel, useful and intelligibly described in the specification. I will go further, and say, that the specification must not attempt to cover more than that which, being matter both of actual and useful discovery, is the only proper subject of a patent. If a patentee seeks by his specification any more than he is strictly entitled to, his patent is rendered ineffectual, even to the extent to which he would otherwise have been entitled. A patent may be valid for a new combination of materials previously in use for the same purpose, or for a new method of applying such materials, but the specification must clearly express that it is only for such new combination or application, and not lay claim to the merit of original invention in the use of the materials."

When this case was first presented to me, I thought the mooring chain was a new combination of old materials, and that the patent was good; I now doubt that, for the specification cannot stand as a description of a new combination of known principles; it claims the form of the link which is not new; it says, the object to be attained is to get the greatest possible strength from a given quantity of materials; as far as that is to be done by introducing a stay across the link in a new mode, viz. with broad ends, supporting and embracing the sides, it would be new; but he goes on to say, "that of all forms for the links, that which shall be able to convert a lateral into an end strain, by supporting the opposite sides of the links, is to be preferred:" here I think it claims the merit of originally using links, with stays across, such as have been used long before.

The invention claimed as to the anchor is, that he avoids the welding of the two arms separately to the shank; but his mode of uniting had been used before in the case of mushroom and adze anchors, and in the pick-axe. If he had stated in the specification, that as welding weakens the anchor, he had first applied to the making of ships anchors, that mode of uniting the shank to the two arms, which had been long practised in making other instruments, viz. making the two arms in one piece, instead of two, then it would have been a question whether such an application could be considered a new invention for a patent; but it is unnecessary to consider that question, because he has claimed the mode of avoiding welding, as a new discovery, when it was not new; he has taken his patent for more than he was entitled to, and that avoids the patent *in toto*. The King has been deceived by the representation made by the patentee, that he had the merit of inventing two things, when he had only discovered one: the Crown might have considered the discovery of the two sufficient ground for granting the patent, when the one alone would not have been thought worthy.

In a deed for grant of lands, if it contained three distinct conveyances, of three distinct estates, on three considerations, one might be set aside and another be good; but if the grant were upon one consideration, which was bad, the whole would be void, because the consideration would fail altogether. In this case the consideration to induce the King to grant the patent, was the statement made by the plaintiff in his petition, that he had made three inventions, when in fact he had made only two; the united consideration upon which the whole grant was made, is therefore void, and consequently the grant itself is void. I am of opinion there ought to be a new trial.

Appendix (B.)

Papers
delivered in by
John Farey, Esq.
8 June 1829.

Salmon against Hampson. An Action for infringement of Salmon's Patent of 1806, for his self-adjusting Truss, for the relief and cure of Ruptures. Tried in the King's Bench in 1821, before Chief Justice Abbott. Verdict for Plaintiff.

This truss is a most valuable invention, which has proved of the greatest service to many thousands of individuals, afflicted with hernia.

The King against Lodge and Bittleston. A *scire facias* to repeal their patent of 20 June 1820, for certain improvements in the construction and application of Spring Trusses or bandages for the relief and cure of Hernia. Tried in the King's Bench 25 October 1822, before Lord Chief Justice Abbott. Verdict for the Crown.

The proceedings were at the suit of Mr. Salmon, who had obtained a patent in 1811, for an invention, which was proved to be substantially the same as that described in the specification of Lodge and Bittleston's patent.

Hall against Gervas and Francis Boot. An Action for infringement of Hall's Patent, 3 November 1817, for a method of improving every kind of Lace or Net. Tried in the King's Bench, 17 December 1822, before Lord Chief Justice Abbott. Verdict for the Patentee.

The invention is to extend the lace net horizontally, and draw it by machinery, with a slow and regular motion, over the flames of gas lights, which flames are urged upwards by a current of air rising through a chimney that is fixed over them, and above the lace, so as to draw the flames upwards through the meshes of the lace, in order to singe and burn away all superfluous fibres from the cotton thread, of which the lace is composed, thereby improving the beauty of the lace very greatly.

The infringement was not proved by very direct evidence; but it was proved, that the defendant had set up the business of bleaching and clear starching lace, and ordered the gas company's pipes to be laid into his workshops to supply a certain number of burners; afterwards the arrangement of the pipes was altered, without any assignable cause, and carried into a part of the shop which was partitioned off, and kept very carefully closed; also, a gas-meter having been applied by the gas company to the entrance pipe, that they might be paid according to the quantity of gas consumed, it was observed, that the consumption was excessive for the professed number of burners, or the size of the shops.

In defence, it was proved, that flame of charcoal, or waste paper, had been long used for singing off the superfluous fibres from lace sleeves, mitts and stockings, but they were always stretched upon a sleeve board, or a wooden leg, during the singing, and the flame was not urged by the draught of a chimney, so as to burn up through the interstices of the lace, in order to singe within-side of the meshes, which is the essence of Mr. Hall's invention. No objection was raised against the specification. *Lord Chief Justice Abbott*: "There can be no doubt but the verdict must pass against both the defendants; one of them has the gas pipe laid into his house."

Barber against Walduck. An Action for infringement of Barber's Patent of 1821, for an improved manner of making Hats. Tried at Lancaster in the summer of 1823, before Mr. Justice Holroyd. Patentee nonsuited.

The patentees were hat manufacturers; and one of their men, whom they called as a witness, proved, that he himself invented the improvement which was the subject of the patent, whilst employed in their workshop. Mentioned on the trial, *Bloxam v. Elsee*, 1825.

Note.—*Messrs. Barker and Harris had a patent, in 1821, for improvements in the method of cleaning furs and wools used in the manufacture of hats, from kemps and hairs; it is stated Barber in the above report, by mistake.*

Savory against Price. An action for infringement of Savory's Patent of 1815, "for a method of making a neutral Salt, or Powder, possessing all the properties of the medicinal spring at Seidlitz, under the name of Seidlitz Powder." Tried in the Court of King's Bench 17 Dec. 1823, before Chief Justice Abbott. The Patentee was nonsuited.

The specification gave three distinct recipes for preparing the ingredients, and then directed two scruples of each of the three ingredients resulting from those recipes to be dissolved in half a pint of water, in order to produce the imitation of Seidlitz water. It was proved that by following the directions given in the specification, the result was obtained, and that it was new and useful. It appeared that the three recipes were only common processes for preparing three well known substances, viz. Rochelle salts, carbonate of soda, and tartaric acid, which were sold in shops before the date of the patent; and those three substances being used as directed, constituted the Patent Seidlitz Powder; the specification did not give any name to the ingredients resulting from the three recipes; but gave those recipes without comment, as if they were part of the method of making the Seidlitz powder.

Ryder and Moody's
Reports,
Vol. I. p. 1.

Lord

Lord Chief Justice Abbott : " It is the duty of a patentee to specify the plainest and most easy way of producing that for which the patent is granted, and to make the public acquainted with the mode which he himself adopts. By reading this specification, we are led to suppose a laborious process necessary to the production of the ingredients, when in fact we might go to any chemist's shop and buy the same things ready made. The public are misled by this specification, which tends to make people believe that an elaborate process is essential to the invention ; it cannot be supported." The plaintiff was accordingly nonsuited.

Papers
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John Farey, Esq.
8 June 1829.

Morton against Barclay and others. An action in Scotland, for infringement of Morton's Patent of 1818, for a method of dragging Ships out of water on dry land. Tried in the Jury Court at Edinburgh, 15 March 1824, before the Lord Chief Commissioner, Lord Gillies, and Lord Pitmilley. Verdict for the Patentee.

The invention is a substitute for a dry dock for repairing ships. It consists of a horizontal frame or very low carriage with rollers, or small wheels adapted to run upon an inclined plane or slip, such as is commonly used for building ships ; also a strong crane work to drag that carriage up the plane, by a chain, when a ship is placed upon the carriage, which can run down the inclined plane so far under water that the ship can be floated over it. A beam which extends along the middle of the carriage, supports blocks on which the keel of the ship is to rest ; and there are several cross beams, on which other blocks are fitted in grooves so as to slide to or from the middle beam, in order to adapt them to block up under the bottom of the vessel, and keep her upright on the carriage : these sliding blocks can be drawn into their places under the bottom, as the vessel settles down on the carriage, after the keel is come to rest on the blocks.

Printed Notes of the
Trial.

The pursuer erected several such patent slips at various places in England and Scotland under his patents, and the defenders made one near Glasgow in infringement thereof ; whereupon the pursuer raised an action in the Court of Session ; the defenders, in answer, denied any infringement, alleging that their machine was different from the pursuer's. The question was remitted to the Jury Court, where defenders did not appear, thereby admitting the infringement. The merit and utility of the invention was proved by the testimonies of several naval officers, engineers, and ship-builders ; several of them taken in writing in England on commission.

The Lord Chief Commissioner made some observations as to the law of Scotland in cases of this nature, and that he thought it would be a desideratum to have the point settled. The pursuer's advocate submitted, that since the Union, the practice in regard to patents was the same in Scotland as in England. The Lord Chief Commissioner said, that as the defenders did not appear, the court must suppose their cause indefensible ; he had never seen a case before any court more fully made out by evidence than the pursuer's. The practice in England rendered it necessary for the pursuer to make out, 1st. That the invention was original, and was made by the patentee himself ; 2d. That his patent right had been invaded. In this case it had been proved that the invention was original ; that it was useful, and preferable to dry docks ; that it would be of the utmost utility in places where there was not a rise and fall of tide ; that the shipwrights working in the dry, may work longer days than in a dock, and can more conveniently use long planks. With regard to the law in questions of this nature, he would say nothing ; he believed that this was the first case which had been brought to trial upon similar issues. No amount of actual damage had been proved, and it was only a question of the right. The jury found a verdict for the pursuer, with one shilling damages and costs.

Bloxam and another, assignees of H. and S. Fourdrinier, bankrupts, against Elsee.

An action for Infringement of Gamble's Patents of 1801 and 1803, for a Machine for making Paper. Tried in the King's Bench, before Chief Justice Abbott, 18 Jan. 1825. Verdict for the Patentees.

The machine acts by the continuous motion of an endless web of woven wire cloth, circulating over horizontal rollers, and forming a moving horizontal plane, on which the pulp is spread at one end, and during the motion thereof, as the pulp advanced to the other end, it is formed into a tissue of paper, which is taken off in a continuous sheet at the other end of the moving plane.

Carrington and
Payne's Reports
of Cases, Nisi Prius,
Vol. I. p. 558.

The patents were assigned by Gamble, in 1804, to H. and S. Fourdrinier, with all interest he might have if an Act of Parliament were passed. In 1807, Gamble and H. and S. Fourdrinier obtained an Act of Parliament (47 Geo. 3. s. 2. c. 131. of private Acts) to prolong the term to 15 years from 1807. H. and S. Fourdrinier became bankrupts in 1810, and then the patents passed to the assignees of bankrupts (the plaintiffs) who held the same for the benefit of more than 20 creditors who had proved debts under the commission. It was objected, that the assignees having the patents assigned to them in trust for more than five persons, contrary to the Act, the privilege had become void, and the case of *Hesse v. Stevenson* was cited. *Chief Justice Abbott* : " The twenty creditors could not grant licences to use the patent right, but the assignees might. I am clearly of opinion that the privilege passes to the assignees."

The new specification and drawings, enrolled in 1807 under the Act, was proved sufficient ; the first one of 1801, contained some French terms, and some dimensions expressed in French measures. J. Gamble, the patentee, admitted that he obtained the invention from Leger Didot, a Frenchman, and acted as his trustee in taking out the first patent in 1801, at which time we were at war with France. It was objected that the patent was void, being held in trust for an alien enemy ; also it appeared that several of the improvements described in the specification, had been invented by Mr. Donkin, an engineer, who was employed by Fourdrinier and Gamble to bring the machine to perfection.

Chief Justice Abbott : " A patentee is not tied down to make a specification by words alone, but he is allowed to annex drawings ; and if by comparison of the words and drawings, the one will explain the other, sufficiently to enable a skilful mechanic to make the machine, it is a sufficient specification."

Appendix (B.)

Papers
delivered in by
John Farey, Esq.
8 June 1829.

specification. By the Act, the last specification is to be taken as a substitute for the former ones, and being good, supplies all their defects and omissions." His Lordship left it to the jury to say whether it was a useful invention, and whether the patent had been infringed by defendant. Verdict for the plaintiffs, with liberty to move for a nonsuit.

On the 27th January 1825, the Court was moved for a Nonsuit or a new Trial, on the following grounds :

1st. That when Gamble took out the first patent, in 1801, for an alien enemy, without disclosing that fact, it was a fraud on the Crown. 2d. That the privilege, under the Act, could not be assigned or held in trust for the benefit of more than five persons, or their representatives, and the assignees of bankruptcy are trustees for the whole body of creditors. 3d. That the first patent was for a machine to make paper from 1 to 12 feet wide, which the machine described in the first specification could not do; and if the first patent fails, the other and the Act fails also. 4th. That four out of five of the improvements mentioned in the second specification, were invented by Mr. Donkin (the case of *Barber v. Walduck* was cited) and the fifth was no improvement at all. 5th. That the first specification contained French expressions and dimensions, and a scale to the drawing in French measures; and if any part of the specification is bad the whole is so.

Chief Justice Abbott : It was proved that the French names to the scale were quite immaterial; for relative proportion (which was all that was wanted) the scale would have been as good, if their had been no names at all. "I am of opinion that the clause in the Act applied only to such assignments as are the act of the party, not to assignments by act of law." *Mr. Justice Bayley* : "The right of Messrs. Fourdrinier passed by a statutable assignment to the assignees, who are their representatives." *Mr. Justice Holroyd* : "I think the assignees are the representatives of the bankrupts, and that they may sell the right." *Mr. Justice Littledale* was of the same opinion. *Mr. Justice Bayley* : "In the case of *Hill v. Thompson*, it is laid down that if a servant make an improvement, his master is not entitled to take a patent for it." The court decided that some of the points deserved serious consideration, and therefore granted a rule for a nonsuit or a new trial.

On the 3d February 1827, another hearing took place in the King's Bench, on the following case :

1st. By the Act 41 Geo. 3, the privilege was to become void in case it should at any time become vested in, or in trust for, more than five persons, or their representatives at any one time, otherwise than by devise or succession (reckoning executors and administrators as the single persons they represent); it was objected that the patent had become vested in the assignees of the bankrupts, in trust, for more than five creditors. Also, 2d. The first patent in 1801, was for a machine for making paper, in single sheets, without seam or joining, from 1 to 12 feet and upwards in width, and from 1 to 45 feet and upwards in length. The second patent, 1803, was for improvements on and additions to the former. It was objected that the machine described in the specification to the first patent, was not capable of making different widths of paper; also that it was not capable of producing useful paper. The Lord Chief Justice reserved the two points, but left the latter to the jury, who thereupon found a verdict for the plaintiffs.

The first point was thus decided by the Judges. *Lord Chief Justice Abbott* : "In my opinion the whole clause in the Act is confined to assignments by acts of the parties, and does not apply to any transfer by operation of law. Under the Ship Register Acts, which has a similar provision; the assignees of a bankrupt take the interest in a ship." *Mr. Justice Bayley* : "The bankrupts did not exceed five, and the bankruptcy, by a statutable transfer, has made the assignees the representatives of the bankrupts." *Mr. Justice Holroyd* : "I think the assignees are to be considered as the representatives of the bankrupts, and not as the representatives of the creditors; although the assignees take the property to convert it into money, and then they hold that money in trust for the creditors." *Mr. Justice Littledale* : "It seems to me, that the words of the Act do not apply to a transfer by operation of law, the assignees represent the bankrupt by operation of law."

On the other point, *Lord Chief Justice Abbott* : "The patent was granted on the representation that a machine would make paper in sheets, of width and length varying within the limits designated; if any material part of that representation was not true, the consideration failed in part, and the grant is void: both width and length are important parts of this representation. I think the words mean, that paper of different widths could be made by the same machine, and it is a different thing, whether a manufacturer must get several different machines, or only one accomplishing the purposes of many. Unfortunately the evidence shows, that the patentee was not possessed of the invention of such a machine; I say unfortunately, because it is to be lamented that the advantage of great ingenuity, labour, anxiety and expense, should be lost to those who have bestowed them on a useful invention; he was not then possessed of any method by which different widths might be made by that machine, or any other. By subsequent improvements a machine was obtained, capable of making paper of width varying within certain limits, but not extending to half the width mentioned in the patent. The specification enrolled by the Act 41 Geo. 3, sufficiently describes such a machine, and a mode of adjusting it to different widths, within the limits of its own breadth, but the first specification is confined to one width only; and though the Act substitutes the new specification in place of the former ones, it cannot operate retrospectively, to enable the patentee to say that he possessed in 1801, or had then discovered a machine, which he did not possess or discover, until a much later date. If the first machine had been capable of working at different widths, though clumsily and imperfectly, the latter machine would have been an improvement of it, but the first as existing actually or in theory, being wholly incapable, the latter was not an improvement of any thing previously existing, but an addition of new matter, not existing at the date of the first patent, but which was nevertheless represented as then existing, and it was an important part of the representation, and consideration, on which the grant was made. If the first grant was void, the subsequent grants by the patent, and the statute,

Barnwell and
Cresswell's Reports,
Vol. VI. p. 169.

statute, must fall, as having nothing to support them. There must be a new trial, because the question ought to have been left to the jury, whether the machine, as originally constructed, was capable of making paper of different widths. I did not leave it so to the jury, because the evidence showed it would not." Rule absolute for a new trial.

Note.—This paper machinery has proved a very valuable invention; it has come into general use, and together with the modern inventions of machines for printing by steam power, has proved a great public benefit. Messrs. Fourdrinier expended all their means in bringing it to perfection and were ruined. The creditors recovered a large proportion of their debts from the exercise of the patent right, but were put to vast expenses in the law proceedings, and, after the above opinions of the Judges, chose to abandon the patent right rather than proceed to a new trial. The printing machine of Koenig, in like manner proved injurious to Mr. Bensley, who purchased the patent, and went to vast expenses in bringing it to bear. Mr. Applegath, who afterwards improved so much upon the original machine as to supersede the patent right, was also ruined by the expenses, notwithstanding that he made a great number of machines.

Papers
delivered in by
John Farey, Esq.
8 June 1829.

The King against Lister. A scire facias to repeal Lister's Patent of 1823, for Improvements in the method and machinery for preparing and spinning Wool, Silk, or other animal fibres. Tried 19 Jan. 1826, in the Court of King's Bench. Verdict for the Crown.

The proceedings were at the suit of Mr. Hadden, who had a patent in 1818 for an invention which was proved to be substantially the same as that described in Mr. Lister's specification. It was for applying heat to the fibres of wool during the operation of spinning it. Mr. Hadden did this by inserting hot iron heaters into hollow rollers between which the slivers of wool passed. Mr. Lister effected the same thing, by applying steam within the hollow rollers, and he also caused the slivers previously to pass through water so as to become wetted, in order to soften the fibres before they came between the heated rollers. It is said that Mr. Lister, at the time of this trial, had granted licences under his patent, to the amount of £. 3,000 per annum.

The King against Hadden. A scire facias to repeal Hadden's patent of 1818, for an Improvement in preparing, spinning and roving Wool. Tried 19 Jan. 1826, in the Court of King's Bench. Verdict for the Crown.

The proceedings were at the suit of Mr. Lister, who had a subsequent patent in 1823, for the same invention, and which was set aside in the previous trial as above. It was proved that the principle of Mr. Hadden's invention had been used long before his patent.

Hills and Haddock against Thompson and Hill. An Action for infringement of Hills and Haddock's patent of 1818, for an Improvement in the manufacture of Sulphuric Acid.

The improvement is to employ iron pyrites, or other metallic sulphurets as a material for producing sulphuric acid, by burning the same in close chambers, and condensing the sulphureous vapour proceeding from the combustion, into sulphuric acid, by the aid of atmospheric air and steam. The patent was supported.

Barton against Hall. An Action for infringement of Barton's patent of 1816, for Improvements in Metallic Pistons for Steam Engines. Tried in the Common Pleas, 11 July 1827, before the Chief Justice. The Patentee was nonsuited.

The pistons, which were alleged by the plaintiff's witnesses to be infringements, were not, in the opinion of the Judge, the same invention as that described in his specification, but were substantially the same as the metallic pistons commonly used long before the patent.

The King against Fussell. A scire facias to repeal Fussell's patent of 1824, for an improved method of heating Woollen Cloth, for the purpose of giving it a lustre in dressing. Tried in the King's Bench in July 1827, before the Lord Chief Justice. Verdict for the Crown.

The proceedings were at the suit of Mr. Daniell, who had a patent in 1819, for a similar process, and which he had brought into very extensive use, with great advantage. After the surface of the cloth has been properly dressed, and the nap on the surface laid very smooth, the piece is rolled up very smoothly and evenly, in a close and compact roll; that roll being immersed in hot water for a sufficient length of time, the fibres of the wool become softened, and after this process they acquire a tendency to retain the same direction; and thus the effect of the dressing is rendered permanent. Mr. Fussell's process being the same, except that he submitted the roller to steam instead of hot water; it was held to be substantially the same invention, and his patent was repealed.

The King against Daniell. A scire facias to repeal Daniell's patent of 1819, for Improvements in dressing Woollen Cloth. Tried in the King's Bench in July 1827, before the Lord Chief Justice. Verdict for the Crown.

The merit and utility of the invention were fully proved, as stated in the preceding trial. One witness was brought to prove that he had practised the same method some years before the date of the patent; he swore that he operated exactly as directed in Daniell's specification, but he could not make out that he had pursued the method, or that he had attained any good result by it, nor was any corroborating evidence given. On this evidence the patent was repealed.

Appendix (B.)

Papers
delivered in by
John Farey, Esq.
8 June 1809.

Moody & Malkin's
Reports,
Vol. I. p. 283.

Crosley against Beverley. An Action for infringement of one part of Clegg's Patent of 1815, for an improved Gas Apparatus, that Patent being assigned to Crosley. Tried in the King's Bench, 20 January 1829, before Lord Tenterden. Verdict for the Patentee.

The specification describes a series of apparatus, constituting a complete apparatus for gas lighting, viz. a retort; a purifying apparatus; a gas-meter, for measuring the quantity of gas supplied from a particular gas-holder, or to any particular purchaser; and a governor for regulating that supply and making it uniform. The infringement was on the gas-meter. Of this series only the gas-meter and the governor have been brought into use; all the others, after being used some time, were laid aside; it was proved that they would, and did, answer the purposes proposed, and that they were clearly described; therefore the patent was supported by the Court. The gas-meter which was the subject of the action, has been greatly improved in construction beyond what is described; but the improved meter was proved to be the same invention, although executed in a simpler and better form than those described in the specification.

The specification stated the improved apparatus to be for extracting gas from "pit-coal, tar, or any other substance from which gas capable of being employed for illuminating, can be extracted by heat." It was objected that the retort was incapable of extracting gas from oil, except very imperfectly, and by the aid of considerable modifications, not provided for by the specification. *Lord Tenterden*: "I must look at the whole of the specification together, and I think it is evident that it only represents the retort as suited to materials of the same kind as coal. I understand, 'other substances' to signify substances then known to be available for illuminating with gas, not every thing which will burn with a flame, for in a certain sense all those produce gas. The evidence states, that oil was not then generally considered as such a substance; and the fact, that some speculations were going on at the time, with respect to its being so, will make no difference. The patentee cannot be required to foresee the success of those speculations, but I must consider him as a practical man, to have spoken of things which practical men then treated as usable for the specified purpose. I must decide against the objection. The law is severe enough in breaking up patents altogether, for a fault in any part of them, without straining it in favour of such an objection."

On the 27th January 1829, Motion was made for a new Trial; but it was refused.

Mr. Clegg, the inventor, having assigned all his interest, had been examined as a witness on the trial; from his evidence it appeared, that at the time he applied for his patent, he had conceived the idea of his gas-meter to be a hollow wheel, partly immersed in water, its interior being divided into chambers, which were to be alternately filled and emptied with gas, in such manner as to cause the wheel to turn round on its axis, in order to measure and record the quantity of gas which passed through those chambers. He made no drawing or model, until after he obtained the patent, and then he made a meter, which is described in the specification; but finding its structure too complicated for general use, he set about another, which is also described in the specification. From this it was objected, that an important part of the invention had been made after the date of the patent, and could not therefore have been included in the representation made to the Crown, as the consideration of the grant.

Mr. Justice Bailey: At the time he took out his patent he had discovered a new method, but between that, and the time he made out his specification, he discovered certain improvements; would not his patent be bad if he had not specified those improvements?

Mr. Justice Littledale: The general statement made in the Petition to the King, viz. "a Gas Apparatus," is equally applicable to the present specification, and to what that specification would have been, if it had been confined to what was passing in his mind at the time he petitioned for his patent.

Lord Tenterden: "The objection really is, whether a patent is void, when the inventor having had in his mind, at the time of applying for it, an invention capable of producing the effect he represented it to be capable of producing; but having brought that invention to a greater degree of perfection within the time allowed by his patent for making the specification, he introduces into that specification a different species of mechanical parts from those he first conceived. No case has ever decided that, and I think it would be extremely dangerous to lay down any such doctrine; I do not see why time is allowed to prepare a specification, except upon the idea that the inventor has not, at the time of obtaining his patent, brought his invention to the degree of perfection that he may be supposed to be capable of doing, and therefore he is allowed further time to do it. If in the interval the invention is perfected, so as to approach to a perfect accomplishment of the object originally in view; I do not see that it can be any objection to the patent."

Mr. Justice Bayley: "I think the specification and the patent are to be taken together as one muniment for enforcing the claims of the patentee. The specification with the new improvement, which has been found out since the date of the patent, would still be the invention for which the patent was obtained. I think it is most beneficial to the public, and best answering the purpose of the Act of Parliament to say, that if between the period of taking out the patent, and enrolling the specification, the inventor makes discoveries which will better effect the object for which the patent was obtained, not only he is at liberty, but it is his bounden duty, to introduce the same into his specification; and that it is not sufficient for him to communicate to the public the knowledge which he had at the time he petitioned, or when he obtained his patent, but he ought also to communicate all the knowledge that he has attained before lodging the specification. I am of opinion that the objection taken to the patent in this case is not to be supported."

Mr. Justice Littledale: "I am also of the same opinion. This patent was taken out for an improved gas apparatus; at the time of applying for it, the inventor had some ideas in his mind which gave him a prospect of doing something beneficial to the public, on that the grant was made, with time allowed for making out a specification. He might be called upon to do it immediately, but time

time is given. In that time something contributing materially to the successful practice of the invention comes into his mind; he finds it will answer, and introduces it into his specification. Now it can only be upon a very strict technical rule, that such addition in the specification to what was passing in his mind when he applied for the patent would render that patent void. It has been held, that if a man applies for a patent for two things, and he is not the inventor of one, or there is some objection to one of them, the whole is void, because it is considered that he made an unfair representation, and obtained a patent unfairly thereupon; and if any one part fails, the whole is to fail also. That appears to me to be only a technical rule, intended to prevent frauds in obtaining patents, or for some other reason, but there is no reason why it should be carried farther than it has been. For the same reason, if any part of the specification is bad from any cause, it may render the whole void. In this case no deception was practised on the crown; the inventor professed to give a gas apparatus, and has done so; nor is any deception practised on the public, for until the enrolment of the specification, the public were unacquainted with the mode in which the invention is to be carried into effect. At first it was merely floating in his mind, but his mind having got into an improving state, is able to give an improvement of a certain value when he petitions the crown for a patent; afterwards, as he puts up the machine, to try if it will answer, and to see that the intended specification will be right, he finds from day to day how to increase the original value, perhaps to double it; surely it would be a hardship, if for thus giving the public a double mode, and adding (when he ascertains the patent) an improvement of double the value of that which was passing in his mind when he applied for his patent, that the whole should be void, and that he should be deprived of the benefit, because he had not in his specification confined his communication to what was passing in his mind at the time his patent was sealed. I think that would be very unjust, and I know of no rule of law by which it should be.

Appendix (B.)

Papers
delivered in by
John Farey, Esq.
8 June 1829.

Felton against Greaves. An action for infringement of Felton's Patent of 1827, for a Machine for sharpening Knives, Scissors and Razors. Tried in the King's Bench 6 June 1829, before Lord Tenterden. Patentee nonsuited.

The description in the specification was judged incomplete, because it would not enable persons to make a machine for sharpening scissors.

FORMS.

FORM OF THE PETITION FOR OBTAINING A PATENT.

To the King's most Excellent Majesty.

The humble Petition of *A. B. of D.* in the County of *E. &c.*

Sheweth,

THAT your petitioner hath after much study and expense, found out and invented [*here state the invention in general, but definite terms expressing neither more nor less than which it is, or the effect it can produce, and the purposes to which it can be applied,*] which your petitioner conceives will be of great public utility; that your petitioner is the first and true inventor thereof, and that the same has not been practised or used by any other person or persons, to the best of his knowledge or belief.

Your petitioner, therefore, most humbly prays your Majesty will be graciously pleased to grant unto him, his executors, administrators, and assigns, your Majesty's royal letters patent under the great seal of the United Kingdoms of Great Britain and Ireland, for the sole use, benefit and advantage of his said invention, within that part of your Majesty's United Kingdom of Great Britain and Ireland called England, your dominion of Wales, and town of Berwick-upon-Tweed, for the term of fourteen years, pursuant to the statute in that case made and provided.

And your petitioner shall ever pray, &c.

FORM OF THE AFFIDAVIT TO BE MADE IN SUPPORT OF THE ALLEGATION OF THE ABOVE PETITION.

A. B. of D. in the county of *E. &c.* maketh oath, and saith, That after much study and expense, he has invented [*here state the invention in exactly the same words as in the petition*] that he is the first inventor thereof, and that the same is entirely new, and has not been practised or used by any other person or persons, to the best of his knowledge and belief.

(signed) *A. B.*

Sworn before a Master in Chancery.

FORM OF A PATENT FOR AN INVENTION FOR ENGLAND, and the Colonies.

GEORGE the FOURTH, by the grace of God, of the United Kingdom of Great Britain and Ireland King, Defender of the Faith, To all to whom these presents shall come, Greeting:

WHEREAS *A. B. of [&c.]* hath by his petition humbly represented unto Us, that [*here the substance of the petition is transcribed, and the exact words of the title therein given to the invention,*] and We, being willing to give encouragement to all arts and inventions which may be for the public good, are

graciously

Appendix (B.)

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graciously pleased to condescend to the petitioner's request. KNOW YE THEREFORE, That We, of Our especial grace; certain knowledge, and mere motion, have given and granted, and by these presents, for Us, Our heirs and successors, Do give and grant unto the said *A. B.* his executors, administrators, and assigns, Our especial licence, full power, sole privilege and authority, that he the said *A. B.* his executors, administrators and assigns, and every of them, by himself and themselves, or by his and their deputy or deputies, servants or agents, or such others as he the said *A. B.* his executors, administrators, or assigns, shall at any time agree with, and no others, from time to time and at all times hereafter, during the term of years herein expressed, shall and lawfully may make, use, exercise and vend his said invention, within that part of Our United Kingdom of Great Britain and Ireland called England, Our dominion of Wales, and town of Berwick-upon-Tweed, [*and also within all Our colonies and plantations abroad*] in such manner as to him the said *A. B.* his executors, administrators and assigns, or any of them, shall in his or their discretion seem meet. And that he the said *A. B.* his executors, administrators and assigns, shall and lawfully may have and enjoy the whole profit, benefit, commodity and advantage, from time to time, coming, growing, accruing and arising by reason of the said invention, for and during the term of years herein mentioned; To have, hold, exercise and enjoy the said licences, powers, privileges and advantages hereinbefore granted or mentioned to be granted unto the said *A. B.* his executors, administrators and assigns, for and during and unto the full end and term of fourteen years from the date of these presents next and immediately ensuing, and fully to be complete and ended, according to the statute in such case made and provided. And to the end that he the said *A. B.* his executors, administrators and assigns, and every of them, may have and enjoy the full benefit and the sole use and exercise of the said invention, according to Our gracious intention hereinbefore declared, We do, by these presents, for Us, Our heirs and successors, require and strictly command all and every person and persons, bodies politic and corporate, and all other Our subjects whatsoever, of what estate, quality, degree, name or condition soever they be, within that said part of Our United Kingdom of Great Britain and Ireland called England, Our dominion of Wales, and town of Berwick-upon-Tweed [*and also within all Our colonies and plantations abroad*] aforesaid, that neither they, nor any of them, at any time during the continuance of the said term of fourteen years hereby granted, either directly or indirectly, do make, use, or put in practice the said invention, or any part of the same, so attained by the said *A. B.* as aforesaid, nor in anywise counterfeit, imitate or resemble the same, nor shall make or cause to be made any addition thereunto, or subtraction from the same whereby to pretend himself or themselves the inventor or inventors deviser or devisers thereof, without the consent, licence or agreement of the said *A. B.* his executors, administrators or assigns, in writing under his or their hands and seals, first had and obtained in that behalf, upon such pains and penalties as can or may be justly inflicted on such offenders for their contempt of this Our royal command; and further to be answerable to the said *A. B.* his executors, administrators and assigns, according to law, for his and their damages thereby occasioned. And moreover We do, by these presents, for Us, Our heirs and successors, will and command all and singular the justices of the peace, mayors, sheriffs, bailiffs, constables, headboroughs, and all other officers and ministers whatsoever, of Us, Our heirs and successors for the time being, that they or any of them do not, nor shall at any time hereafter, during the said term hereby granted, in any wise molest, trouble or hinder the said *A. B.* his executors, administrators or assigns, or any of them, or his or their deputies, servants or agents, in or about the due and lawful use or exercise of the said invention, or any thing relating thereto: Provided always, and these Our letters patent are, and shall be upon this condition, that if at any time, during the said term hereby granted, it shall be made appear to Us, Our heirs or successors, or any six or more of Our or their Privy Council, that this Our grant is contrary to law, or prejudicial or inconvenient to Our subjects in general, or that the said invention is not a new invention, as to the public use and exercise thereof, in that said part of Our United Kingdom of Great Britain and Ireland called England, Our dominion of Wales, and town of Berwick-upon-Tweed; [*and also within all Our colonies and plantations abroad*] aforesaid, or not invented and found out by the said *A. B.* as aforesaid; then upon signification or declaration thereof, to be made by Us, Our heirs or successors, under Our or their signet or privy seal, or by the Lords, and others of Our or their Privy Council, or any six or more of them under their hands, these Our letters patent shall forthwith cease, determine and be utterly void, to all intents and purposes, any thing hereinbefore contained to the contrary thereof in anywise notwithstanding: Provided also, that these Our letters patent, or any thing herein contained, shall not extend or be construed to extend, to give privilege unto the said *A. B.* his executors, administrators or assigns, or any of them, to use or imitate any invention or work whatsoever, which hath heretofore been invented or found out by any other of Our subjects whatsoever, and publicly used or exercised in that said part of Our United Kingdom of Great Britain and Ireland called England, Our dominion of Wales and town of Berwick-upon-Tweed, [*and also within all Our colonies and plantations abroad*] aforesaid, unto whom Our like letters patent or privileges have been already granted, for the sole use, exercise and benefit thereof; it being Our will and pleasure, that the said *A. B.* his executors, administrators and assigns, and all and every other person and persons to whom like letters patent or privileges have been already granted as aforesaid, shall distinctly use and practise their several inventions by them invented and found out according to the true intent and meaning of the same respective letters patent, and of these presents: Provided likewise nevertheless, and these Our letters patent are upon this express condition, that if the said *A. B.* his executors or administrators, or any person or persons who shall or may, at any time or times hereafter, during the continuance of this grant, have or claim any right, title or interest in law or equity, of, in, or to the power, privilege and authority of the sole use and benefit of the said invention hereby granted, shall make any transfer or assignment, or any pretended transfer or assignment of the said liberty and privilege, or any share or shares of the benefit or profit thereof, or shall declare any trust thereof, to or for any number of persons, exceeding the number of five, or shall open or cause to be opened, any book or books for public subscriptions, to be made by any number of persons exceeding the number of five, in order to the raising any sum or sums of money, under pretence of carrying on the said liberty or privilege hereby granted; or shall by him or themselves, or his or their agents or servants, receive any sum or sums of money whatsoever, of any number of persons, exceeding in the whole the number of five, for such or the like intents or purposes, or shall presume to act as a corporate body, or shall divide the benefit of these Our letters patent, or the liberty and privileges hereby by Us granted, into any number of shares exceeding the number of five, or shall commit or do, or procure to be committed or done, any act, matter or thing whatsoever, during such time as such person or persons shall have any right or title, either in law or equity, in or to the said premises, which will be contrary to the true intent and

Appendix (B.)

Papers
delivered in by
John Farey, Esq.
8 June 1829.

and meaning of a certain Act of Parliament made in the sixth year of the reign of King George the First, intituled, "An Act for the better securing certain powers and privileges intended to be granted by His Majesty, by two charters, for assurance of ships and merchandize at sea, and for lending money upon bottomry, and for restraining several extravagant and unwarrantable practices therein mentioned;" or in case the said power, privilege or authority shall at any time hereafter become vested in, or in trust for more than the number of five persons, or their representatives, at any one time (reckoning executors or administrators as and for the single person whom they represent, as to such interest as they are or shall be entitled to in right of such their testator or intestate); and also if the said *A. B.* shall not particularly describe and ascertain the nature of his said invention, and in what manner the same is to be performed, by an instrument in writing under his hand and seal, and cause the same to be enrolled in Our High Court of Chancery, within [*two or four or*] six calendar months next and immediately after the date of these Our letters patent; and also if the said *A. B.* his executors, administrators or assigns, shall not supply or cause to be supplied for Our service, all such articles of the said invention as he or they shall be required to supply, in such manner, at such times, and at and upon such reasonable prices and terms as shall be settled for that purpose by the Master General of Our Ordnance, or the principal officers of the Ordnance for the time being; that then and in any of the said cases, these Our letters patent, and all liberties and advantages whatsoever hereby granted, shall utterly cease, determine and become void; any thing hereinbefore contained to the contrary thereof in anywise notwithstanding: And lastly, We do by these presents, for Us, Our heirs and successors, grant unto the said *A. B.* his executors, administrators and assigns, that these Our letters patent, or the enrolment or exemplification thereof, shall be in and by all things good, firm, valid, sufficient and effectual in the law according to the true intent and meaning thereof, and shall be taken, construed and adjudged in the most favourable and beneficial sense, for the best advantage of the said *A. B.* his executors, administrators and assigns, as well in all Our courts of record as elsewhere, and by all and singular the officers and ministers, whatsoever of Us, Our heirs and successors, in that part of Our said United Kingdom of Great Britain and Ireland called England, Our dominion of Wales, and town of Berwick-upon-Tweed [*and also within all Our colonies and plantations abroad*] aforesaid, and amongst all and every the subjects of Us, Our heirs and successors whatsoever and wheresoever, notwithstanding the not full and certain describing the nature or quality of the said invention, or of the materials thereunto conducing and belonging. In witness whereof We have caused these Our letters to be made patent. Witness Ourselves at Westminster this day of in the year of Our reign.

By writ of privy seal,
SCOTT.

FORM FOR THE SPECIFICATION OF A PATENT INVENTION.

TO all to whom these Presents shall come, I, *A. B.* of *C.* in the County of *D.* &c. send Greeting:

WHEREAS I did, by petition, represent to His most Excellent Majesty King George the Fourth, that I had invented [*here state the invention in the same terms as in the Patent*] and His said Majesty being willing to encourage all useful inventions, did issue his Letters Patent, under the Great Seal of Great Britain, bearing date at Westminster, the day of in the year of his reign, whereby His said Majesty did for himself, His heirs and successors, give and grant unto me, the said *A. B.* His especial license, that I the said *A. B.* my executors, administrators and assigns, or such others as I the said *A. B.* my executors, administrators and assigns, should at any time agree with, and no others, from time to time, and at all times, during the term of years therein expressed, should and lawfully might make, use, exercise and vend within England, Wales and the town of Berwick-upon-Tweed [*and also within all His Majesty's colonies and plantations abroad*] my said invention: In which said Letters Patent there is contained a proviso, obliging me, the said *A. B.* by an instrument in writing, under my hand and seal, particularly to describe and ascertain the nature of my said invention, and in what manner the same is to be performed; and to cause the same to be enrolled in His Majesty's High Court of Chancery within [*two or four or*] six calendar months next, and immediately after the date of the said recited Letters Patent, as in and by the same reference being thereunto had will more fully and at large appear: Now know ye, that in compliance with the said proviso, I the said *A. B.* do hereby declare, that the nature of my said invention, and the manner in which the same is to be performed, is described and ascertained in manner following (that is to say); [*Here the particulars of the invention are to be minutely and accurately described in such terms as will enable competent persons to practise the invention in the most complete manner; and also the points of invention of which the exclusive right is claimed, must be clearly distinguished from such other matters as may be necessarily described in the specification to render it intelligible, but which are not of new invention.*]

In witness whereof, I, the said *A. B.* have hereunto set my hand and seal, the day
of in the year of our Lord one thousand eight hundred and *A. B.* (seal.)

Taken and acknowledged by the above-named *A. B.* at the Public Office,
Southampton Buildings, Chancery Lane, this day of before me, a Master in Chancery.

Inrolled in the Petty Bag Office in His Majesty's High Court of Chancery,
the day of in the year of the reign
of George the Fourth.

[Certificate of Inrolment.]

Appendix (B 1.)

Paper
delivered in by
Mr. Wyatt,
1 June 1829.

Appendix (B 1.)

An ACCOUNT of the Number of PATENTS granted for INVENTIONS, from the year 1675 to 1829 inclusive; also, a List of the Patents in force, 1815—1829; from a Registry in the possession of Mr. W. H. Wyatt, an Agent for obtaining Patents.

YEAR.	Nº	YEAR.	Nº	YEAR.	Nº
CHARLES II.		GEORGE I.—continued.		GEORGE III—continued.	
1675 - - -	4	1725 - - -	9	1778 - - -	30
1676 - - -	2	1726 - - -	5	1779 - - -	38
1677 - - -	3	GEORGE II.		1780 - - -	32
1678 - - -	5	1727 - - -	7	1781 - - -	34
1679 - - -	2	1728 - - -	12	1782 - - -	39
1680 - - -	—	1729 - - -	8	1783 - - -	64
1681 - - -	5	1730 - - -	11	1784 - - -	46
1682 - - -	7	1731 - - -	9	1785 - - -	60
1683 - - -	7	1732 - - -	3	1786 - - -	59
1684 - - -	12	1733 - - -	6	1787 - - -	54
JAMES II.		1734 - - -	8	1788 - - -	43
1685 - - -	5	1735 - - -	6	1789 - - -	44
1686 - - -	3	1736 - - -	—	1790 - - -	68
1687 - - -	6	1737 - - -	3	1791 - - -	57
1688 - - -	4	1738 - - -	6	1792 - - -	84
WILLIAM & MARY.		1739 - - -	3	1793 - - -	43
1689 - - -	1	1740 - - -	4	1794 - - -	55
1690 - - -	3	1741 - - -	8	1795 - - -	50
1691 - - -	20	1742 - - -	6	1796 - - -	73
1692 - - -	24	1743 - - -	7	1797 - - -	54
1693 - - -	19	1744 - - -	17	1798 - - -	77
1694 - - -	9	1745 - - -	4	1799 - - -	82
1695 - - -	8	1746 - - -	4	1800 - - -	96
1696 - - -	3	1747 - - -	8	1801 - - -	104
1697 - - -	3	1748 - - -	11	1802 - - -	105
1698 - - -	8	1749 - - -	13	1803 - - -	74
1699 - - -	4	1750 - - -	7	1804 - - -	60
1700 - - -	2	1751 - - -	8	1805 - - -	95
1701 - - -	1	1752 - - -	6	1806 - - -	99
ANNE.		1753 - - -	11	1807 - - -	96
1702 - - -	—	1754 - - -	9	1808 - - -	95
1703 - - -	1	1755 - - -	12	1809 - - -	102
1704 - - -	4	1756 - - -	3	1810 - - -	95
1705 - - -	1	1757 - - -	9	1811 - - -	115
1706 - - -	4	1758 - - -	14	1812 - - -	119
1707 - - -	3	1759 - - -	10	1813 - - -	143
1708 - - -	2	GEORGE III.		1814 - - -	94
1709 - - -	3	1760 - - -	8	1815 - - -	99
1710 - - -	—	1761 - - -	14	1816 - - -	118
1711 - - -	3	1762 - - -	9	1817 - - -	98
1712 - - -	3	1763 - - -	20	1818 - - -	130
1713 - - -	2	1764 - - -	14	1819 - - -	101
GEORGE I.		1765 - - -	14	GEORGE IV.	
1714 - - -	4	1766 - - -	30	1820 - - -	98
1715 - - -	3	1767 - - -	23	1821 - - -	108
1716 - - -	8	1768 - - -	23	1822 - - -	113
1717 - - -	6	1769 - - -	36	1823 - - -	138
1718 - - -	6	1770 - - -	30	1824 - - -	181
1719 - - -	2	1771 - - -	22	1825 - - -	249
1720 - - -	7	1772 - - -	30	1826 - - -	131
1721 - - -	7	1773 - - -	29	1827 - - -	148
1722 - - -	13	1774 - - -	36	1828 - - -	152
1723 - - -	7	1775 - - -	20	1829 - - -	37
1724 - - -	14	1776 - - -	29		
		1777 - - -	33	TOTAL - - -	5,539

LIST OF PATENTS IN FORCE.

June to Dec. - - -	1815 - - -	53	June to Dec. - - -	1824 - - -	181
— - - - -	1816 - - -	118	— - - - -	1825 - - -	249
— - - - -	1817 - - -	98	— - - - -	1826 - - -	131
— - - - -	1818 - - -	130	— - - - -	1827 - - -	148
— - - - -	1819 - - -	101	— - - - -	1828 - - -	152
— - - - -	1820 - - -	98	January to May - - -	1829 - - -	37
— - - - -	1821 - - -	108			
— - - - -	1822 - - -	113	TOTAL - - -	1,855	
— - - - -	1823 - - -	138			

Appendix (C.)

Appendix (C.)

American Law.

American Law of Patents.

Papers
delivered in by
John Farey, Esq.
8 June 1829.

AMERICAN ACT, PASSED 21 FEBRUARY 1793.

*An Act to promote the Progress of useful Arts, and to repeal
the Act heretofore made for that purpose.*

SECTION 1.—BE it Enacted, by the Senate and House of Representatives of the United States of America, in Congress assembled: That when any person or persons, being a citizen or citizens of the United States, shall allege that he or they have invented any new and useful art, machine, manufacture or composition of matter, or any new and useful improvement, on any art, machine, manufacture or composition of matter, not known or used before the application, and shall present a petition to the Secretary of State, signifying a desire of obtaining an exclusive property in the same; and praying, that a patent may be granted therefor; it shall and may be lawful for the said Secretary of State to cause letters patent to be made out in the name of the United States, bearing test by the President of the United States, reciting the allegations and suggestions of the said petition, and giving a short description of the said invention or discovery, and thereupon granting to such petitioner or petitioners, his, her or their heirs, administrators or assigns, for a term not exceeding fourteen years, the full and exclusive right and liberty of making, constructing, using and vending to others, to be used, the said invention or discovery; which letters patent shall be delivered to the attorney general of the United States, to be examined, who, within fifteen days after such delivery, if he finds the same conformable to this Act, shall certify accordingly at the foot thereof, and return the same to the Secretary of State, who shall present the letters patent thus certified to be signed, and shall cause the seal of the United States to be thereto affixed; and the same shall be good and available to the grantee or grantees by force of this Act, and shall be recorded in a book to be kept for that purpose, in the office of the Secretary of State, and delivered to the patentee or his order.

Letters Patent, how
and by whom made
out.

To bear test by the
President, and to

be examined by the
Attorney General.

Sect. 2.—Provided always, and be it further Enacted, That any person who shall have discovered an improvement in the principle of any machine, or in the process of any composition of matter, which shall have been patented, and shall have obtained a patent for such improvement, he shall not be at liberty to make, use or vend the original discovery, nor shall the first inventor be at liberty to use the improvement; and it is hereby enacted and declared, that simply changing the form or the proportions of any machine or composition of matter, in any degree, shall not be deemed a discovery.

The liberty of using an
Improvement defined.

Sect. 3.—And be it further Enacted, That every inventor, before he can receive a patent, shall swear or affirm, that he does verily believe that he is the true inventor or discoverer of the art, machine or improvement for which he solicits a patent; which oath or affirmation may be made before any person authorized to administer oaths; and shall deliver a written description of his invention, and of the manner of using, or process of compounding the same, in such full, clear and exact terms, as to distinguish the same from all other things before known, and to enable any person skilled in the art or science of which it is a branch, or with which it is most nearly connected, to make, compound and use the same; and in the case of any machine, he shall fully explain the principle, and the several modes in which he has contemplated the application of that principle or character, by which it may be distinguished from other inventions; and he shall accompany the whole with drawings and written references, where the nature of the case admits of drawings, or with specimens of the ingredients, and of the composition of matter, sufficient in quantity for the purpose of experiment, where the invention is a composition of matter; which description, signed by himself and attested by two witnesses, shall be filed in the office of the Secretary of State, and certified copies thereof shall be competent evidence, in all courts where any matter or thing touching such patent right shall come in question; and such inventor shall moreover deliver a model of his machine, provided the Secretary shall deem such model to be necessary.

How to proceed to
obtain Letters Patent.

Sect. 4.

Note.—The American Law, as above, was originally translated by Mr. Farey from a French edition, printed in an official publication, entitled, *Description des Machines et procédés spécifiés dans les Brevets d'Invention*. Paris, quarto 1811. Vol. I. p. 565. It is there stated to be translated from, *The Acts passed in the first Session in the second Congress of the United States of America, began the 24th October 1791, in the 16th year of their Independence*. Vol. II. p. 200. Chapter XI. Mr. Farey has not been able to procure that original, but has lately obtained an American edition of the Acts, in *An Essay on the Law of Patents for New Inventions*, by T. G. Fessenden. Boston 1810, 8vo. p. 193. The coincidence between the re-translation from the French and the American edition, leaves no doubt of the accuracy of the above copy.

Appendix (C.)

American Law.

Papers
delivered in by
John Farey, Esq.
8 June 1829.

Inventors may assign
their Titles.

Forfeiture on using
Patent Inventions
without leave.
How recovered.

How Defendants may
give this Act in evi-
dence;

and Judgment shall
be given.

State rights to Inven-
tions, when to be
deemed void.

How Applications de-
pending under former
Law, shall be prose-
cuted under this Act.

Proceedings to be had
on interfering Appli-
cations;

and against Persons
surreptitiously obtain-
ing Patents.

Inventor, before pre-
sented Petition, to pay
30 dollars into the
Treasury.

Copying Fees.

Sect. 4.—And be it further Enacted, That it shall be lawful for any inventor, his executor or administrator, to assign the title and interest in the said invention at any time, and the assignee having recorded the said assignment in the office of the Secretary of State, shall thereafter stand in the place of the original inventor, both as to right and responsibility, and so the assignees of assigns, to any degree.

Sect. 5.*—And be it further Enacted, That if any person shall make devise and use, or sell the thing so invented, the exclusive right of which shall as aforesaid have been secured to any person by patent, without the consent of the patentee, his executors, administrators or assigns, first obtained in writing; every person so offending shall forfeit and pay to the patentee a sum that shall be at least equal to three times the price for which the patentee has usually sold or licensed to other persons the use of the said invention; which sum may be recovered in an action on the case, founded on this Act, in the circuit court of the United States, or any other court having competent jurisdiction.

Sect. 6.—Provided always, and be it further Enacted, That the defendant in such action shall be permitted to plead the general issue, and to give this Act, and any special matter (of which notice in writing may have been given to the plaintiff, or his attorney, thirty days before trial) in evidence, tending to prove, that the specification filed by the plaintiff, does not contain the whole truth relative to his discovery, or that it contains more than is necessary to produce the described effect; which concealment or addition shall fully appear to have been made for the purpose of deceiving the public; or that the thing thus secured by patent was not originally discovered by the patentee, but had been in use, or had been described in some public work, anterior to the supposed discovery of the patentee; or that he had surreptitiously obtained a patent for the discovery of another person; in either of which cases judgment shall be rendered for the defendant, with costs, and the patent shall be declared void.

Sect. 7.—And be it further Enacted, That where any State, before its adoption of the present form of government, shall have granted an exclusive right to any invention, the party claiming that right, shall not be capable of obtaining an exclusive right under this Act, but on relinquishing his right under such particular State; and of such relinquishment, his obtaining an exclusive right under this Act shall be sufficient evidence.

Sect. 8.—And be it further Enacted, That the persons whose applications for patents were, at the time of passing this Act, depending before the Secretary of State, Secretary at War, and Attorney General, according to the Act passed the second Session of the first Congress, intitled, "An Act to promote the progress of useful Arts," on complying with the conditions of this Act, and paying the fees herein required, may pursue their respective claims to a patent under the same.

Sect. 9.—And be it further Enacted, That in case of interfering applications, the same shall be submitted to the arbitration of three persons, one of whom shall be chosen by each of the applicants, and the third person shall be appointed by the Secretary of State; and the decision or award of such arbitrators, delivered to the Secretary of State in writing, and subscribed by them, or any two of them, shall be final, as far as respects the granting of the patent: and if either of the applicants shall refuse, or fail to choose an arbitrator, the patent shall issue to the opposite party; and where there shall be more than two interfering applications, and the parties applying shall not all unite in appointing three arbitrators, it shall be in the power of the Secretary of State to appoint three arbitrators for the purpose.

Sect. 10.—And be it further Enacted, That upon oath or affirmation being made before the judges of the district court, where the patentee, his executors, administrators or assigns reside, that any patent which shall be issued in pursuance of this Act, was obtained surreptitiously, or upon false suggestion, and motion being made to the said court, within three years after issuing the said patent, but not afterwards, it shall and may be lawful for the said judge of the said district court, if the matter alleged shall appear to him to be sufficient, to grant a rule that the patentee, or his executor, administrator or assign, do shew cause why process should not issue against him to repeal such patent; and if sufficient cause shall not be shewn to the contrary, the rule shall be made absolute, and thereupon the judge shall order process to be issued against such patentee, or his executors, administrators or assigns, with cost of suit; and in case no sufficient cause shall be shewn to the contrary, or if it shall appear that the patentee was not the true inventor or discoverer, judgment shall be rendered by such court, for the repeal of such patent; and if the party at whose complaint the process issued, shall have judgment given against him, he shall pay all such costs as the defendant shall be put to, in defending the suit, to be taxed by the court, and recovered in due course of law.

Sect. 11.—And be it further Enacted, That every inventor, before he presents his petition to the Secretary of State, signifying his desire of obtaining a patent, shall pay into the treasury thirty dollars, for which he shall take duplicate receipts, one of which receipts he shall deliver to the Secretary of State, when he presents his petition; and the money thus paid, shall be in full for the sundry services to be performed in the office of the Secretary of State, consequent on such petition, and shall pass to the account of clerk-hire in that office: Provided nevertheless, that for every copy which may be required at the said office, of any paper

* Note.—Section 5th was repealed by a subsequent Act, passed 17 April 1800. Section 4.

paper respecting any patent that has been granted, the person obtaining such copy shall pay at the rate of twenty cents, for every copy sheet of one hundred words; and for every copy of a drawing, the party obtaining the same shall pay two dollars; of which payment an account shall be rendered annually to the Treasury of the United States, and they shall also pass to the account of the clerk-hire, in the office of the Secretary of State.

Sec. 12.—And be it further Enacted, That the Act passed the tenth day of April, in the year one thousand seven hundred and ninety, intituled, “An Act to promote the progress of the useful Arts,” be, and the same is hereby repealed; provided always, that nothing contained in this Act, shall be construed to invalidate any patent that may have been granted under the authority of the said Act; and all patentees under the said Act, their executors, administrators and assigns, shall be considered within the purview of this Act, in respect to the violation of their rights, provided such violations shall be committed after the passing of this Act.

Jonathan Trumbull, Speaker of the House of Representatives.

John Adams, Vice President of the United States, and President of the Senate.

Approved, February 21, 1793,

Geo. Washington, President of the United States.

Appendix (C.)

American Law.

Papers
delivered in by
John Farey, Esq.
8 June 1829.

Former Act repealed.

AMERICAN ACT, PASSED 17 APRIL 1800.

An Act to extend the privilege of obtaining Patents for useful Discoveries and Inventions, to certain persons therein mentioned, and to enlarge and define the Penalties for violating the Rights of Patentees.

SECTION 1.—BE it Enacted, by the Senate and House of Representatives of the United States of America, in Congress assembled, That all and singular the rights and privileges given, intended or provided to citizens of the United States, respecting patents for new inventions, discoveries and improvements, by the Act, intituled, “An Act to promote the progress of useful Arts, and to repeal the Act heretofore made for that purpose,” shall be, and hereby are, extended and given to all aliens, who, at the time of petitioning in the manner described by the said Act, shall have resided for two years within the United States; which privileges shall be obtained, used and enjoyed by such persons, in as full and ample manner, and under the same conditions, limitations and restrictions, as by the said Act is provided and directed, in the case of citizens of the United States; provided always, that every person petitioning for a patent for any invention, art or discovery pursuant to this Act, shall make oath or affirmation, before some person duly authorized to administer oaths, before such patent shall be granted, that such invention, art or discovery hath not, to the best of his or her knowledge or belief, been known or used, either in this, or any foreign country; and that every patent which shall be obtained pursuant to this Act, for any invention, art or discovery, which it shall afterwards appear had been known or used previous to such application for a patent, shall be utterly void.

Persons having resided two years within the United States, entitled to the benefit of the former Act.

Oaths to be taken by such resident.

Sect. 2.—And be it further Enacted, That where any person hath made, or shall have made any new invention, discovery or improvement, on account of which a patent might, by virtue of this, or the above-mentioned Act, be granted to such persons as shall die before any patent shall be granted therefor, the right of applying for and obtaining such patent, shall devolve on the legal representatives of such person, in trust for the heirs at law of the deceased, in case he shall have died intestate, but if otherwise, then in trust for his devisees, in as full and ample manner, and under the same conditions, limitations and restrictions, as the same was held, or might have been claimed or enjoyed by such person in his or her lifetime; and when application for a patent shall be made by such legal representatives, the oath or affirmation provided in the third section of the before-mentioned Act, shall be so varied as to be applicable to them.

The legal Representatives of the deceased Inventor may obtain a Patent.

Sect. 3.—And be it further Enacted, That where any patent shall be, or shall have been granted pursuant to this or the above-mentioned Act, and any person without the consent of the patentee, his or her executors, administrators or assigns, first obtained in writing, shall make, devise, use or sell the thing whereof the exclusive right is secured to the said patentee by such patent, such person so offending, shall forfeit and pay to the said patentee, his executors, administrators or assigns, a sum equal to three times the actual damage sustained by such patentee, his executors, administrators or assigns, from or by reason of such offence; which sum shall and may be recovered by action on the case, founded on this and the above-mentioned Act, in the circuit court of the United States, having jurisdiction thereof.

Damages for breach of Patent Rights.

Sect. 4.—And be it further Enacted, That the fifth section of the above-mentioned Act, intituled, “An Act to promote the progress of the useful Arts, and to repeal the Act heretofore made for that purpose,” shall be and hereby is repealed.

Repeal of part of the former Act.

Theodore Sedgwick, Speaker of the House of Representatives.

Tho. Jefferson, Vice President of the United States, and President of the Senate

Approved, 17 April, A. D. 1800,

John Adams, President of the United States.

Appendix (C.)

American Law.

Papers
delivered in by
John Farey, Esq.
8 June 1829.

FORMS USED IN AMERICA FOR OBTAINING PATENTS, &c.

FORM OF PETITION.

To the Hon. R. S. Esq. Secretary of State, of the United States of America.

THE Petition of A. B. of B. in the County of S. and State of M. Gentleman, humbly sheweth,
That he has invented, constructed, made, and applied to use, a new and useful improvement in the mode
of making or manufacturing [here say what] by machinery at one operation [or] called the [insert
the name of the thing invented. Vide form of specification.]

Your Petitioner is therefore desirous of obtaining an exclusive property in his said improvement, and
humbly prays that Letters Patent, duly executed according to law, may be granted him; therefore
as in duty bound will ever pray.

Your most obedient and very humble servant,

B. 25 August 1810.

A. B.

FORM for the SPECIFICATION to be delivered with the Petition.

TO all persons to whom these Presents shall come, A. B. of B. in the County of S. and State
of M. Gentleman, sends greeting; Be it known that I the said A. B. have invented, con-
structed, made and applied to use, a new and useful improvement [here say what as above] called
[here insert the name] specified in the words following; viz. This improvement in [here
specify the improvement definitely.]

In testimony that the above is a true specification of my said improvement, as above described,
I have hereto set my hand and seal, the twenty-fifth day of _____ in the year of our
Lord _____ in presence of _____

{ C. D. }
{ E. F. } witnesses.

A. B.
seal.

S s s B. Aug. 25. A. D. 1810. Then personally appeared the above named A. B. and made
oath, That he does verily believe that he is the true inventor or discoverer of his said im-
provement, as by him above specified.*

Sufficient testimony was also produced to prove that said A. B. is a citizen of the United
States of America.

Before me, S. G.

Justice of the Peace for said County.

* Note.—If he is an alien, then insert, “or that the same has not, to his best knowledge or belief, been
before known, or used in this or in any foreign country;” and also insert, “that he has resided more than
two years last past in America, &c.”

FORM OF LETTERS PATENT for The United States of America.

To all to whom these Letters Patent shall come:

WHEREAS A. B. a Citizen of the State of M. in the United States, hath alleged that he
has invented a new and useful improvement, being [here is inserted the technical name, or a
short description of the nature of the invention] which improvement has not been known or
used before his application, has made oath, that he does verily believe that he is the true inventor
or discoverer of the said improvement; has paid unto the Treasury of the United States the
sum of Thirty dollars, delivered a receipt for the sum, and presented a Petition to the Secretary
of State, signifying a desire of obtaining an exclusive property in the said improvement; and
praying that a patent may be granted for that purpose. These are therefore to grant to the
said A. B. his heirs, administrators or assigns, the full and exclusive right and liberty of
making, constructing, using and vending, to others to be used, the said improvement; a de-
scription whereof is given in the words of the said A. B. himself, in the Schedule hereto annexed,
and is made a part of these presents.

In testimony whereof, I have caused these letters to be made patent, and the seal of the United
States is hereunto affixed.

(L. S.)

Given under my hand, at the City of Washington, this _____ day of _____
in the year of our Lord one thousand eight hundred and _____ and the [] year
of the Independence of the United States of America.

By the President, J. M.
R. S. Secretary of State.

Note.—The above are extracted from Fessenden's Essay, where it is stated that the above forms for
the petition, and also for the oath or attestation of the inventor, were prepared by a gentleman at the bar,
and have been approved of at Washington.

City of Washington, } I do hereby certify, That the following letters patent were delivered to me on the
to wit. } [] day of [] in the year of our Lord one thousand eight hundred
and } to be examined; That I have examined the same and find them conformable
to law. And I do hereby return the same to the Secretary of State within fifteen days from
the date aforesaid, to wit on this day of [] in the year aforesaid.

C. A. R. Attorney General of the United States.

Appendix (C.)

American Law.

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To these Letters Patent is annexed the following SCHEDULE.

The Schedule referred to in these Letters Patent, and making part of the same, containing a description in the words of the said A. B. himself, of his [here is recited the specification with the inventor's signature, and that of the witness to the specification.]

DECLARATION in an Action on the Case, for infringing a PATENT in America.

TO answer to [] in a plea of trespass on the case: For that whereas by certain letters patent, made out in due form of law, in the name and under the seal of the United States, dated the [] day of [] in the year of our Lord [] and in court to be produced, was granted to the plaintiff, a citizen of the United States, and to his heirs, administrators or assigns, for the term of fourteen years from the said date, the full and exclusive right and liberty of making, constructing, using and vending to others to be used, his invention [or improvement] of [here insert the technical name or term by which the art, &c. &c. or improvement, &c. is known and distinguished in the patent.] And the plaintiff in fact says, that the defendant, well knowing the premises, but contriving and fraudulently intending to injure the plaintiff in this behalf, did on the said [] day of and at [] divers times between that day, and the day of the purchase of this writ, to wit at said [] without the consent of the plaintiff in that behalf first obtained in writing, or otherwise, unlawfully devise, make and use the said invention [or improvement] so invented by the plaintiff, and secured to him as aforesaid, contrary to the form of the statute of the United States, made and passed on the twenty-first day of February, in the year of our Lord one thousand seven hundred and ninety-three, intitled, "An Act to promote the progress of the useful Arts, and to repeal the Act heretofore made for that purpose:" By means of which and by force of another statute of the United States made and passed on the seventeenth day of April in the year of our Lord eighteen hundred, intitled, "An Act to extend the privilege of obtaining Patents for useful Discoveries and Inventions to certain persons therein mentioned, and to enlarge and define the penalties for violating the rights of Patentees," the defendant has forfeited to the plaintiff a sum equal to three times the actual damage sustained by the plaintiff, from or by reason of the premises; which actual damage the plaintiff avers, is equal to the sum of [] dollars, and an action hath accrued to the plaintiff to have and recover of the defendant the said sum of [] dollars; yet the defendant, though often requested, hath never paid the said sum to the plaintiff's damages, &c.

Note.—In Fessenden's Essay on the Law of Patents, 8vo. Boston 1810, many decisions and points of legal practice in America are stated; and also such precedents of English courts of law as have been cited in American proceedings.

Appendix (D.)

French Law.

Papers
delivered in by
John Farey, Esq.
8 June 1829.

Appendix (D.)

French Law of Patents.

LAW relative to useful DISCOVERIES, and to the Means of ensuring the Property thereof, to those who are acknowledged to be the Authors of the same.

Given at Paris, the 7th January 1791, (No. 308.)

Louis, by the Grace of God, and by the Constitutional Law of the State, King of the French ; to all present and to come ;—greeting,

The National Assembly has Decreed, and we Will and Order, as follows ;

DECREE of the National Assembly of the 31st December 1790.

THE National Assembly, considering that every new idea, whereof the manifestation or the developement may become useful to society, belongs originally to him who has conceived it; and that it would be to attack the rights of man in their essence, not to regard a discovery in industry (*in useful arts and manufactures*) as the property of its author : considering at the same time, how much the want of a positive and authentic declaration of this truth may have contributed hitherto to discourage French industry, by occasioning the emigration of many distinguished artists, and by causing a great number of new inventions, from which this empire ought to have drawn the first advantages, to pass to foreign countries : considering in short, that all the principles of justice, of public order, and of national interest, require imperatively that for the future, the opinion of the French citizens, respecting this species of property, should be fixed, by a law which shall protect and render it sacred, It is decreed as follows :

ARTICLE 1st.—Every discovery or new invention, in all kinds of industry, is the property of its author ; in consequence the law guarantees to him the full and entire enjoyment of the same, according to the mode and for the term hereinafter determined.

2d.—Every means of adding to any fabrication (*manufacture*) whatsoever, a new degree of perfection shall be regarded as an invention.

3d.—Whoever is the first to bring into France, a foreign discovery, shall enjoy the same advantages as if he were the inventor thereof.

4th.—He who would preserve or secure to himself a manufacturing property, of the kind of those stated in the preceding articles, shall be required,

1st.—To apply to the secretariat of the directory in his department, and there declare, in writing, if the object that he presents is of new invention, of improvement, or only of importation.

2d.—To deposit in a sealed packet, an exact description of the principles, means and processes which constitute the discovery, as well as the plans, sections, drawings, and models which may be relative thereto; in order that the said packet may be opened at the time when the inventor receives his title of property.

5th.—Respecting objects of general utility, but too simple in their execution, and too easy to be imitated, to establish any commercial speculation thereon;—and in all cases, when the inventor prefers to treat directly with the government, he shall be at liberty to apply, either to the administrative assemblies or to the legislative body, if need be, to confide his discovery, to demonstrate the advantages of it, and solicit a recompense.

6th.—When an inventor shall have preferred, to the personal advantages secured by the law, the honour of ceding at once to the nation, the fruits of his discovery or invention, and when he shall prove, by public notoriety, and by legal attestations, that his discovery or invention is of real utility, he may have awarded to him, a recompense out of the funds destined for the encouragement of industry.

7th.—In order to assure to every inventor the property and the enjoyment of his invention for a time, there shall be delivered to him a title or patent, according to the form indicated in the regulation which shall be drawn up for the execution of the present decree.

Note.—This translation of the French laws is made from an official copy, printed in *Description des Machines et procédés spécifiés dans les Brevets d'Invention. Paris, quarto, 1811. Vol. I. p. 37, 40 & 46.* It includes all the amendments and additions which have been made in the original law, by subsequent laws, and therefore forms a correct version of the law of Patents now actually in force in France. Mr. Farey has endeavoured to make the translation a literal one, and nothing is omitted.

8th.—The

8th.—The patents shall be given for five, ten or fifteen years, according to the choice of the inventor; but the latter term can never be prolonged without a particular decree of the legislative body.

Appendix (D.)

French Law.

10th.—The inventor shall be required, in order to obtain the said patents, to apply to the directory of his department, which shall undertake to procure the same to be made out in proper form. The patents sent to that directory shall be there registered, and there shall be at the same time notice given thereof by the minister of the interior, to the directories of other departments.

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11th.—Any citizen shall be at liberty to inspect the catalogue of new inventions at the secretariat of his department, and also any resident citizen (*citoyen domicilié*) shall be at liberty to examine the specifications of the patents actually in force, at the general depositary established for that purpose; nevertheless the descriptions shall not be communicated in the case where the inventor (having judged that political or commercial reasons require that his discovery should be kept secret) shall have applied to the legislative body to explain his motives, and shall have obtained a particular decree for that object. In the case when it shall be declared that a description shall remain secret, commissioners shall be appointed to examine as to the exactitude of the description, after a view of the means and processes, without the author ceasing, on that account, to be afterwards responsible for that exactitude.

12th.—The proprietor of a patent shall enjoy, exclusively, the exercise and the fruits of the discovery, invention or improvement, for which the said patent shall have been obtained; in consequence, he may* bring his action against infringers before the tribunals. When infringers shall be convicted, they shall be condemned, *in addition to the confiscation*,† to pay damages to the inventor proportioned to the magnitude of the infringement, and besides, to pay into the fund for the poor of the district, a fine fixed at one-fourth of the amount of the said damages, but nevertheless that fine shall not exceed the sum of three thousand livres, or double that sum in case of a second offence.

13th.—In case the complaint of infringement‡ shall be found devoid of proof, the inventor shall be condemned to pay to the adverse party, damages proportioned to the trouble and injury he may have sustained; and besides, to pay into the fund for the poor of the district a fine fixed at one-fourth of the amount of the said damages, but nevertheless that fine shall not exceed the sum of three thousand livres, or double that sum in case of a second offence.

14th.—Every proprietor of a patent shall have a right to form establishments throughout the extent of the kingdom, and even to authorize other persons to apply and use his means and processes; and in all cases he may dispose of his patent as a personal property.

15th.—At the expiration of each patent, the discovery or invention should belong to the public; therefore the description thereof shall be made public, and it shall be lawful to use the same throughout the kingdom, in order that every citizen may fairly exercise and enjoy the fruits of it, unless a decree of the legislative body shall have prolonged the exercise of the patent, or shall have ordered it to be kept secret, according to the cases provided for in Article 11.

16th.—The description of the discovery contained in the patent, shall also be made public, and the use of the means and processes relating to that discovery, shall also be declared free throughout the kingdom, whenever the proprietor of the patent shall forfeit his patent; which shall only take place in the cases hereinafter determined:

1. Every inventor convicted of having, in giving his description, concealed his real means of execution, shall forfeit his patent.

2. Every inventor convicted of having used in his manufactures, secret means which were not detailed in his description, or of which he shall not have made a declaration to cause them to be added to those given in his description, shall forfeit his patent.

3. Every

Note.—Article 9, was as follows in the original law: “The exercise of patents granted for a discovery imported from a foreign country, cannot be continued beyond the term fixed in that country, for the exercise by the first inventor.” This article was abrogated by a decree of the Emperor Napoleon, dated 13 August 1810, which declares, that the term for patents of importation shall be the same as those for invention or improvement, according to Article 3.

Article 10, was as follows in the original law: “The patents, engrossed on parchment and sealed with the national seal, shall be enregistered in the secretariats of the directories of all the departments of the kingdom; and it is sufficient for obtaining them, to apply to those directories, who will undertake to procure them for the inventor.” This Article was re-modelled as in the text, by a subsequent law of the 25 May 1791.

* *Note.*—The following words stood here, in the original law, “On giving good and sufficient security, procure the counterfeit objects to be seized, and”—but these words were annulled by the law of the 25th May 1791.

† The words *in addition to the confiscation*, being obviously the sequel of the passage so annulled, ought also to have been expunged.

‡ *Note.*—The following words stood here in the original law: “in consequence of which the seizure shall have taken place.” They were annulled by the law of the 25 May 1791.

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3. Every inventor, or person calling himself an inventor, who shall be convicted of having obtained a patent for discoveries already pointed out, and described in works printed and published, shall forfeit his patent.

4. Every inventor who, in the space of two years, reckoning from the date of his patent, shall not have put his discovery in practice, or shall not have given sufficient reasons to justify his inaction, shall forfeit his patent.

5. Every inventor who, having obtained a patent in France, shall be convicted of having taken one for the same object in any foreign country, shall forfeit his patent.

6. Lastly, every person acquiring the right of exercising a discovery secured by a patent, shall be subject to the same regulations as the inventor; and if he infringes them, the patent shall be revoked, the discovery published, and the use thereof shall be open throughout the kingdom.

17th.—The National Assembly does not intend any violation of the exclusive privileges granted heretofore *for inventions and discoveries*, provided all the legal forms have been observed for those privileges; but they shall have their full and entire effect, and moreover the possessors of those former privileges shall be subject to the conditions of the present decree. Other privileges, founded on simple orders in council, or upon letters patent not registered, shall be converted without charge into patents, but only for the time which they have yet to run; provided it be shown that the said privileges have been obtained for discoveries and inventions of the kind of those specified in the preceding articles. The proprietors of the said former privileges which are registered, and of those converted into patents, may dispose of them as they please, conformably to Article 14.

18th.—The committee of agriculture and commerce, in concert with the committee of taxes, shall lay before the National Assembly a project of regulations, which shall fix the taxes upon patents to inventors according to the time they are to remain in force, and which shall embrace all the details relative to the execution of the various articles contained in the present decree.

We command and order all the tribunals, administrative and municipal bodies, that they cause these presents to be transcribed into their records, and to be read, published, and posted up in their respective governments and departments, and to be executed as a law of the kingdom. In witness whereof, we have signed, and caused to be countersigned, these said presents, to which we have caused to be affixed the seal of the State, at Paris, the seventh day of January the year one thousand seven hundred and ninety one, and the seventeenth of our reign.

(signed) *Louis.*

and underneath, *M. L. F. Duport*; and sealed with the seal of the State.

LAW containing REGULATIONS for the PROPERTY of the AUTHORS of INVENTIONS and DISCOVERIES in all KINDS of MANUFACTURES.

Given at Paris, the 25th May 1791. (N° 935.)

Louis, by the Grace of God, and by the Constitutional Law of the State, King of the French, to all present and to come;—Greeting,

THE National Assembly has Decreed, and we Will and Order as follows:

DECREE of the National Assembly, the 29th, 31st March, 7th April and 14th May 1791.

REGULATION for the execution of the law of the 7th January 1791, on the Property of the Authors of Inventions and Discoveries in all kinds of Manufactures.

TITLE I.

ARTICLE 1st.—IN conformity with the three first articles of the law of the 7th January 1791, relating to new discoveries and inventions in all kinds of manufactures:—There shall be delivered, on a simple petition to the king, and without previous examination, national patents, under the denomination of *Patents of Invention*, (whereof the form is annexed to the present regulation, Number II.) to all persons who shall desire to execute, or to cause to be executed in the kingdom, useful arts or manufactures (*objets d'industrie*) until then unknown.

2d.—There shall be established at Paris, conformably to Article 11, of the law, under the direction and authority of the minister of the interior, (who is appointed to deliver the said patents) a general office, under the name of “Directory of Patents of Invention,” wherein those patents shall be passed, after the previous formalities, and according to the method hereafter determined.

3d.—The Directory of Patents of Invention shall make out the said patents, on the petitions which shall be forwarded to their office by the secretariats of departments. Those petitions shall contain the name of the petitioner, his proposition, and his petition to the king; and joined thereto shall be a packet, containing the exact description of all the means which

which he purposes to employ; and to that packet shall be added the drawings, models and other papers, deemed necessary for the explanation of the subject of the petition; the whole with the signature, and under the seal of the petitioner. On the back of the cover of this packet, shall be inscribed an attestation, (in the form annexed to the present regulation, N° 1.) signed by the secretary of the department, and by the petitioner, to whom shall be delivered a duplicate of the said attestation, the date of the deposit of the packet, a receipt for the amount of the tax, or an engagement to pay it, at the rate, and within the time fixed by the present regulation.

4th.—The Directories of Departments, as well as the Directory of Patents of Invention, shall not receive any petition which shall contain more than one principal object, with the details which may relate to it.

5th.—The Directories of Departments shall be held obliged to forward to the Directory of Patents of Invention, the packets of the petitioners made up in the forms hereinbefore prescribed, during the same week in which the petition shall have been presented.

6th.—On the arrival of the dispatch from the secretariat of the department to the Directory of Patents of Invention, the attestation inscribed on the back of the packet shall be registered, the packet shall be opened, and the patent shall be forthwith drawn up according to the form annexed to the present regulation (N° II.) That patent shall contain an exact copy of the description, and also of the drawings or models enumerated in the attestation, after which, the said patent shall be sealed and sent to the department, under the seal of the Directory of Patents of Invention; at the same time there shall be addressed to all the tribunals and departments of the kingdom, a proclamation of the king, relative to the patent of invention, and in the form hereunto annexed, (N° III.); and these proclamations shall be registered in order of dates, and posted up in the said tribunals.

7th.—The description of the objects which the legislative body, (in the cases provided for by the Article 11, of the law of 7th January) shall have ordered to be kept secret, shall be opened and inscribed by numbers at the Directory of Inventions, in a register by themselves, in presence of commissioners named for that purpose, conformably to the said article of the law; then those descriptions shall be resealed, and a certificate to that effect shall be drawn up by the said commissioners; the decree which shall have ordered them to be kept secret shall be transcribed on the back of the packet; mention thereof shall be made in the proclamation of the king, and the packet shall remain sealed until the term of the patent, unless a decree of the legislative body shall order it to be opened.

8th.—The prolongation of patents, which in very rare cases and for important reasons, may be granted by the legislative body, only during such time as that legislature shall last, shall be registered in a register by themselves at the Directory of Inventions, which shall be held obliged to give notice of that registry to the different departments and tribunals of the kingdom.

9th.—The orders of council, letters patent, descriptive memoirs, all documents and papers relative to privileges of invention, hitherto granted for objects of manufacture, in whatever public office they may be, shall be collected as soon as can be done in the Directory of Patents for Invention.

10th.—The expenses of the establishment shall not be at the charge of the public treasury, but shall be taken solely from the produce of the tax upon patents of invention, and the surplus shall be employed for the advantage of the national industry.

TITLE II.

ARTICLE 1st.—Whoever wishes to obtain a patent of invention shall be bound, conformably to the Article 4, of the law of the 7th January, to apply to the secretariat of the directory of his department, to deliver his petition to the king, with the description of his method, as well as the drawings and models relative to the objects of his demand, conformably to the Article 3d of Title 1st; he shall join thereto two copies of a list, signed by himself, of all the papers contained in the packet; one of those duplicate copies must be sent back to the secretariat of the department by the director of patents for invention, who will take charge of all the papers, by his receipt at the bottom of the said list.

2d.—The petitioner shall have the right, before signing the attestation, to have information given him of the catalogue of all the subjects for which patents shall have been obtained, in order to judge whether he ought to persist in his demand or not.

3d.—The petitioner shall be held obliged, conformably to Article 3d of Title 1st, to pay at the secretariat of the department, the tax upon the patent, according to the scale (tarif) annexed to the present regulation (No. 4,) but he shall be at liberty to pay only half that tax on presenting his petition, and to lodge his engagement to pay the remainder within six months.

4th.—If the engagement of the patentee to pay, is not fulfilled within the prescribed time, the patent which shall have been delivered to him, shall be null; the exercise of his right shall be laid open, and notice thereof shall be given to all the departments, by the Directory of Patents of Invention.

Appendix (D.)

French Law.

Papers
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John Farey, Esq.
8 June 1829.

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French Law.

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5th.—Every person provided with a patent of invention shall be held obliged to pay, besides the tax upon the said patent, the *tax of annual patents* levied upon all professions in the useful arts and trades, by the law of the 17th March 1791.

6th.—Every proprietor of a patent who may wish to make changes in the object stated in his first petition, shall be obliged to make a declaration thereof, and to lodge the description of his new method at the secretariat of the department, in the form prescribed by Article 1st of the present Title; and the same formalities shall be observed in regard thereto, between the Directories of Departments and the Directory of Patents of Invention.

7th.—If the patentee wishes to enjoy the exclusive use of such new method only during the term of his patent, the Directory of Patents of Invention shall give him a certificate, in which his new declaration shall be mentioned, as also the deposit of the packet containing the description of his new method. He shall also be at liberty to take successively new patents for the said changes, as he may make them, or else to unite them under one patent, if he presents them in a body. These new patents shall be passed in the same manner, and according to the same form, as patents for invention, and shall have the same effects.

8th.—If any person announces a method of improvement, upon an invention already the subject of a patent, he shall obtain, on his petition, a patent for the exclusive use of the said method of improvement, but he shall not be allowed, on any pretext, to execute or cause to be executed the principal invention; and, reciprocally, the first inventor shall not be allowed to execute by himself, the new method of improvement. No mere changes of form or proportions, nor ornaments of whatsoever kind, shall be put on the footing of *improvements in manufactures*.

9th.—Any person having acquired, by transfer, the property of a patent, obtained for an object that the tribunals shall have judged contrary to the laws of the kingdom, to the public safety, or to the regulations of the police, shall forfeit his right, without having any claim for indemnity; leaving it to the public ministry to take such measures as they may deem suitable, according to the importance of the case.

10th.—When the proprietor of a patent shall be interfered with in the exercise of his exclusive right, he may proceed according to the forms prescribed for other civil actions at law, before a Justice of the peace, to cause the infringer to be condemned in the penalty decreed by the law.

11th.—The Justice of the Peace shall hear the parties and their witnesses, shall order such examinations (*verifications*) as may be necessary; and the judgment which he shall pronounce shall be executed provisionally, notwithstanding any appeal therefrom.

12th.—In case a judicial seizure shall not have caused the discovery of any article fraudulently made or sold, the plaintiff shall incur the penalties stated in the Article 13th of the law, unless he can support his plea by legal proof; in which case he shall be exempted from the aforesaid penalties, but without having any claim for damages.

13th.—The same proceedings shall take place in case of a contest between two patentees, whose patents are for the same object; if the similarity is declared complete, the patent bearing the earliest date shall alone be valid; if there is a dissimilarity in some parts, the patent of the latest date may be converted, (without any new tax,) into a patent for improvement, for those methods which shall not have been included in the patent of the first date.

14th.—The proprietor of a patent may form any associations he chuses for the exercise of his right, if conformable to the usages of commerce; (* *but he is forbidden to establish his speculation by joint stock shares, on pain of forfeiting his right to his patent.*)

15th.—When the proprietor of a patent shall have ceded his right, wholly or in part, (which he can only do by a legally executed deed,) the two contracting parties shall be held, (under pain of their contract becoming void,) to cause that transfer to be registered (according to the form N° V.) at the *secrétariat* of their respective departments, which will immediately inform the Directory of Patents of Inventions thereof, in order that the latter may give notice of the same, to the other departments.

16th.—In compliance with the Art. 17th of the law of the 7th January, all possessors of those exclusive privileges, which are maintained by the said Article, shall be bound, within six months after the publication of the present regulation, to cause the titles of their privileges to be registered at the Directory of Inventions, and to deposit there the descriptions of the objects so protected by privilege, conformably to Art. 1st of the present Title; all this under penalty of their privileges becoming void.

TITLE III.

ONLY ARTICLE.—The National Assembly refers to the Minister of the Interior, the measures to be taken for the execution of the regulation upon the law for patents of invention;

* Note.—This passage was abrogated by a decree of the Emperor Napoleon, dated Berlin, 25 Nov. 1806.

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French Law.

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John Farey, Esq.
8 June 1829.

N° 3.—FORM of the REGISTRY of a TRANSFER of a Patent of Invention.

N° department of this day of
the month of 179 N. [or N. N.] presented himself, [or presented
themselves] at our secretariat, to desire the registry of the transfer that they have made [or
that has been made to them] to N. [or N. N.] or by N. [or N. N.] by deed executed on
the day of 179 before M notary at of
the whole [or part] of the patent of invention granted the day of
179 for the space of five [ten or fifteen] years, for [here state the title of the patent];
which registry we have granted to him [or them] and we have received the sum of
for the tax fixed by the scale [tarif] annexed to the regulation of on the
law of the 7th Jan. 1791; and the said N. [or N. N.] has [or have] signed with us.
Done at the 179 (signed) N. N. N.

N° 4.—SCALE of TAXES to be paid to the Directory for Inventions.

	livres.
Tax on a patent for five years - - - - -	300
Tax on a patent for ten years - - - - -	800
Tax on a patent for fifteen years - - - - -	1,500
Fee for passing the patent - - - - -	50
Certificate of improvement, change or addition - - - - -	24
Tax for the prolongation of a patent - - - - -	600
Registry of a patent of prolongation - - - - -	12
Registry of the conveyance of a patent, wholly or in part - - - - -	18
For the search and communication of a description - - - - -	12

SCALE of DUTIES to be paid to the Secretariat of the Department.

	livres.
For the attestation of the deposit of a description, or of any im- provement, change or addition, and of the papers relating thereto; all costs included - - - - -	12
For the registry of the conveyance of a patent, wholly or in part; all costs included - - - - -	12
For the communication of the catalogue of inventions, and search fees - - - - -	3

N. B. These amend-
ments have been noticed
in their places, p. 223.

The National Assembly has decreed the following alterations in the text of the law of the 7th January 1791:

The following to be substituted for the Article 10: "The inventor shall be required, in order to obtain the said patents, to apply to the directory of his department, which shall undertake to procure the same to be made out in proper form. The patents sent to that directory shall be there registered, and there shall be at the same time notice given thereof by the minister of the interior, to the directors of other departments."

The Assembly has decreed the suppression of the following words: Article 12. "on giving good and sufficient security, procure the counterfeit objects to be seized, and." Also Article 13. "in consequence of which the seizure shall have taken place."

We command and order, all the tribunals, administrative and municipal bodies, that they cause these presents to be transcribed upon their records, to be published and posted up in their respective jurisdictions and departments, and to be executed as a law of the kingdom. In witness whereof, we have signed and caused to be countersigned these said presents, to which we have caused to be affixed the seal of the State; at Paris, the 25th day of the month of May, the year of our Lord one thousand seven hundred and ninety-one, and the eighteenth of our reign.

(signed) Louis.

and underneath, M. L. F. Duport; and sealed with the seal of the State.

LAW relating to REMUNERATIONS and AIDS to be granted to ARTISTS.

Given at Paris, the 12th Sept. 1791, (N° 1269.)

Decree of 9th Sept. 1791.

The National Assembly having heard the report of its Committee of Agriculture and Commerce, decrees as follows:

TITLE I.—Distribution of National Rewards.

ARTICLE 1st.—From out of the fund of two millions, destined by the decree of 3d Aug. 1790, to be annually employed in gifts, rewards and encouragements, there shall be distributed a sum of 300,000 livres, according to the manner hereinafter determined, in gratuities,

gratuities and assistances to those artists, who by their discoveries, their labours and their researches in the useful arts, shall have deserved to have a share in the national rewards.

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Article 2d.—The said rewards shall be granted, according to the instructions sent concerning the several artists, by the directory of the department of their ordinary abode, and upon the attestation of their district, and the certificate of their municipality; nevertheless it shall be enough for those artists to obtain a certificate from the administrative bodies of their ordinary abode, if those bodies are sufficiently informed to grant it to them.

Article 3d.—The works for which national rewards may be granted, shall be divided into two principal classes; those which may have caused expenses and sacrifices of any kind to be incurred, and those which from their nature do not require any.

In the rewards belonging to each of these two classes, there shall be established three degrees, under the name of minimum, medium and maximum, applicable in proportion to the merit of the objects, conformably to the recommendation of a commission of consultation for the arts, which shall be established to that effect in Paris, and whereof the composition shall be determined in Title 2, of the present decree.

The medium shall be one quarter of the minimum more than that minimum; and the maximum one-half of the minimum more than that minimum.

In the first class, the minimum shall be 4,000 livres, the medium 5,000 livres, and the maximum 6,000 livres.

In the second class the minimum shall be 2,000 livres, the medium 2,500, the maximum 3,000 livres.

Such artists as shall have passed the age of 60 years, shall obtain, over and above the reward which has been fixed for them, a sum equal to the minimum of their class.

Article 4th.—Independently of these two classes, there may be granted rewards to indigent artists, whose talents shall have been acknowledged by the scientific bodies, and whose honourable indigence shall be certified by the administrative bodies.

	livres.
The minimum of these rewards shall be - - - - -	200
The medium - - - - -	250
The maximum - - - - -	300

Such of these artists as shall have passed the age of 60 years, shall obtain, conformably to Article 3, a sum equal to the minimum of their class.

5th.—The minister of the interior shall be nevertheless authorized to propose to the National Assembly to grant an extraordinary reward for discoveries of great importance, made in the kingdom, or imported from foreign countries, particularly when those discoveries shall be the result of arduous exertions, or of long and dangerous journeys.

6th.—A part of the same funds may also be employed, in conformity with the instructions of the administrative bodies, either in the publication of works which may have been deemed useful to the progress of the arts, or in experiments, trials and the construction of models, or even of machines, whereof the advantages and the practicability shall be verified by the judgment of the commission of consultation, but whereof the cost would exceed the means of the inventors.

7th.—There shall be published annually, in a printed list, a statement of the names of those artists, who during the course of the year shall have obtained national rewards, with the general account of the sums devoted to those rewards, as well as to the publication of works, and to the cost of experiments, and constructions, ordered by the minister of the interior, conformably to the opinion of the commission of consultation.

8th.—The pensions granted by a patent signed by the king, to such artists as have on that condition, heretofore ceded to the state their inventions, discoveries or importations, being legally certified, shall be looked upon as part of the public debt, and be attended to, in the liquidation thereof.

9th.—Those artists with whom the administration of commerce has heretofore contracted conditional engagements, and who shall prove that they have fulfilled all the conditions stipulated, shall also be looked upon as creditors of the State, for the sums which shall not yet have been paid to them, and as such their claims shall be attended to, in the liquidation.

10th.—Those artists whose machines, imported from foreign countries, or lately constructed by demand of the administration of commerce, may have been destroyed during the popular troubles that have taken place in any part of the kingdom, shall be indemnified for their losses, upon an attestation by the magistrature of the said places, to which should be annexed an evaluation made by men competent to the same; such attestations shall be held as titles, and received as such in the liquidation.

11th.—The objects already rewarded or bought by government, or for which the artists may have obtained patents of invention, shall not be the subject of national rewards.

12th.—No artist, whatever his works may be, can be allowed in the same year, to receive beyond the *maximum* of the first class; but honourable mention shall be made of him on publication of the list of those rewarded, and he may be admitted the next year.

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Decree of 10th September 1791, (N° 1278.)

UNTIL the National Assembly shall have legislated upon the organization of the bureau of consultation of arts and trades, (arts et métiers) it authorizes the minister of the interior to distribute, as much as the tenth part of the funds destined for the said rewards, in temporary aids, from 100 to 300 livres, to indigent artists, whose works, attested by the administrative body, shall have obtained the authentic approbation of the Academy of Sciences; and the said aids shall be deducted from the rewards which may be decreed to the said artists, on the recommendation of the bureau of consultation of arts and trades.

20th September 1792. A law was passed by the National Assembly, prohibiting any grants of patents for establishments relative to new sources of public finances; and annulling several such patents which had been previously granted.

Resolution of the Executive Directory, concerning the publication of Patents for Inventions.

Of the 17th Vendemiaire an VII. (8 October 1798.)

THE Executive Directory, upon the Report of the Minister of the Interior.

CONSIDERING, That according to the terms of Article 15, of the law of the 7th of January 1791, *relative to useful discoveries, and to the means of ensuring the property thereof to the authors of the same*; every patent of invention obtained for a manufacturing discovery ought to be published at the expiration of the term fixed for its duration, that the processes which are the object of the patent may become general and permitted practices throughout all the republic; that the establishment of patents of invention, took place on the 25 May 1791, and that several of those issued since that date, have attained the term fixed for their duration, and ought to be published according to the law; that it is important to render this publication as useful as it can be, to the progress of the arts, and to the instruction of the public; they have resolved as follows:—

Article 1st.—The patents of invention issued since the law of the 25th May 1791, and which have attained the term prescribed for their duration, shall be immediately published by the care of the minister of the interior; the use of the manufacturing processes for which they are granted, being declared free and permitted throughout all the republic.

2d.—The originals of the said patents shall be deposited in the conservatory of arts and trades, to be referred to if wanted. The minister shall direct the members of the conservatory to cause the descriptions to be printed, and the drawings necessary for their explanation to be engraved. Copies of each patent thus published, shall be addressed to the central administrations of departments.

3d.—The expense which this publication will occasion, shall be taken from the proceeds of the tax upon patents, and if there is a deficiency, out of the general fund provided for the encouragement of the arts.

4th.—The Executive Directory, in conformity with the law, declares the following patents to be expired, and proper to be published, at the date of the present resolution.

(Fourteen such patents are then named.)

The present resolution shall be inserted in the bulletin of laws.

A true copy. (signed) *Treilhard*, President.

By order of the Executive Directory, the Secretary General *Lagarde*.

29 August 1798. A project for a resolution was presented to the Council of Five Hundred, to conform the laws of the 7th January and 25th May 1791, with some judicious amendments; but it was not passed into a law.

Resolution relative to the Mode of granting Patents of Invention.

Of the 5th Vendemiaire, an. IX. (27 Sept. 1800.) (B. N° 46.)

THE Consuls of the Republic having heard the Council of State, order as follows;

ARTICLE 1st.—Dating from this day, the certificate of a petition for a patent of invention shall be delivered by the minister of the interior; and the patents shall afterwards be delivered, every three months by the First Consul, and promulgated in the bulletin of laws.

2d.—To

Note.—The publication ordered by this resolution, appears to have been delayed until 1811, when a first volume was published in quarto, entitled, *Descriptions des Machines et procédés spécifiés dans les Brevets d'Invention*. Since that time 15 or 16 volumes of the work have been published.

2d.—To prevent the abuses which the patentees might make of their titles, there shall be inserted as a note at the bottom of each patent, the following declaration :

“ The government, in giving a patent of invention, without previous examination, does not undertake to guarantee, in any manner, the priority, the merit, or the success of an invention.”

3d.—The minister of the interior is entrusted with the execution of the present order, which shall be inserted in the bulletin of laws.

Signed by { the First Consul, *Bonaparte*.
the Secretary of State, *Hugues B. Maret*.
the Minister of Justice, *Abrial*.

Imperial Decree which abrogates an Enactment of the Law of the 25th May 1791, relative to the Property of Authors of Discoveries.

Imperial Head Quarters at Berlin, 25 Nov. 1806. (B. 126.)

Napoleon, Emperor of the French, King of Italy.

Upon the Report of our minister of the interior, and having heard our Council of State,
We have decreed, and do decree, as follows ;

ARTICLE 1st.—The enactment of Article 14, under Title II. of the law of the 25th May 1791, containing regulations for the property of the authors of discoveries in all kinds of manufactures, is abrogated, as far as concerns the prohibition to carry into effect patents of invention by joint stock shares (*actions*.)

Those who may wish to use their patent rights in such manner, shall be bound to provide themselves with an order of the government to that effect.

2.—Our minister of the interior is entrusted with the execution of our present decree.

Signed by { the Emperor *Napoléon*.
the Secretary of State, *Hugues B. Maret*.

Imperial Decree fixing the period from which the exercise of Patents of Invention, of Improvement, and of Importation, may take date.

Imperial Camp at Varsovie, 25th January 1807. (B. 136.)

Napoleon, Emperor of the French, King of Italy.

Upon the Report of our minister of the interior, and having heard our Council of State,
We have decreed, and do decree, as follows ;

ARTICLE 1st.—The exercise of the term of a patent of invention, of improvement, or of importation, commences from the date of the certificate of petition, delivered by our minister of the interior ; this certificate establishes in favour of the petitioner a temporary enjoyment, which becomes definitive by the issuing of the decree, which will follow the certificate.

2d.—The priority of invention, in case of dispute between two patentees for the same object, belongs to him who has first deposited with the *secretariat* of the *préfecture* of the department in which he resides, the papers required by Article 4th of the law of 7th January 1791.

3d.—Our minister of the interior is entrusted with the execution of the present decree.

Signed by { the Emperor *Napoléon*.
the Secretary of State, *Hugues B. Maret*.

Decree, enacting that the term of Patents for Importation shall be the same as that of Patents for Invention and Improvement.

Imperial Palace of St. Cloud, 13th August 1810.

NAPOLEON, Emperor of the French, King of Italy ; on the report of our minister of the interior, being desirous of putting in accordance the Articles 3d and 9th of the law of 7th January 1791 ; whereof one decides, that an importer of a foreign invention into France shall enjoy the same advantages as if he were the author of it ; and the other, that the term of that enjoyment shall not extend beyond the term fixed in that foreign country for the exercise by the original inventor.

Having heard our Council of State, We have decreed, and do decree as follows :—

ARTICLE 1st.—The term of patents of importation, shall be the same as that of patents of invention and improvement. Any individual who shall have first brought into France a

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foreign discovery, is in consequence at liberty to take out patents for five, ten or fifteen years at his option, conformably to the regulations prescribed by the laws of the 7th January and 25th May 1791.

2d.—Our minister of the interior is entrusted with the execution of the present Decree.

Signed by

The Emperor *Napoléon*.

Countersigned by {

the Minister Secretary of State, *H. B. Duc de Bassano*.
Count of the Empire, Minister of the Interior, *Montalivet*.

Note.—The last decree has not been legally published. The amendment of the law of the 7th January is noticed in its proper place.

18 August 1810. An imperial decree was passed to prohibit any grants of patents, for objects which belong to the class of secret medicines.

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Belgian Law.

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delivered in by
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8 June 1829.

Patent Law of the Netherlands.*

Law of the 25th January 1817, relative to the granting of exclusive Rights for the Invention or Improvement of objects of Arts and Manufactures.

We, William, by the Grace of God, King of the Netherlands, Prince of Orange-Nassau, Grand-Duke of Luxemburg, &c. &c.

TO all who shall see these Presents greeting ; Be it known :—

Having taken into consideration, that it is for the public good to establish general regulations for granting exclusive rights for the invention or improvement of objects of arts or manufactures ; on these reasons, having heard our council of state, and in concurrence with the States General, We have decreed as, We do decree by these presents :—

ARTICLE 1st.—Exclusive rights may be granted by us, for a limited time, by letters patent, under the title of patents of invention, on petitions which shall be made to us for the same, to those who, in the kingdom, shall have made an invention or essential improvement in any branch of arts or manufactures ; and also to those who shall first introduce, or practise in the kingdom, an invention or improvement made in foreign countries.

2d.—The grants of patents of invention shall not interfere with any rights previously acquired by others ; and the grant shall be void, if it is proved that the invention, or the improvement for which any one shall have obtained a patent, have been employed, put in operation, or exercised by another in the kingdom, before the grant of the patent.

3d.—Patents of invention shall be granted for the terms of five, ten or fifteen years. The tax to be paid for obtaining a patent, shall be proportionate to the duration of the patent and to the importance of the invention or improvement ; but shall never exceed the sum of 750 francs, nor be less than 150 francs.

4th.—A patent of invention granted for the term of five or ten years, may also be prolonged at the expiration of that term, if there are strong reasons to support the petition made to that effect ; but its total duration can never exceed the term of fifteen years.

5th.—Patents of invention for the introduction or application of inventions or improvements made in foreign countries, and for which the inventors have patents in those countries, shall not be granted for a longer time, than that during which the exclusive right granted in such foreign country for those objects shall last ; and they shall contain an express clause, that the objects named shall be manufactured in the kingdom.

6th.—Patents of invention shall give to their possessors the right, or their agents, the right.

(a) Of making and selling exclusively throughout the kingdom, during the time fixed for the duration of the patent, the objects named in it ; or of causing them to be made, and sold, by others whom they shall authorize to do so.

(b) Of citing before the courts of law those persons who shall infringe upon the exclusive right which has been granted to them, and of proceeding against such persons at law, in order to obtain the confiscation, for their own advantage, of those objects named in the patent, which have been made by such persons, but not yet sold ; and also, of the price obtained for those objects which shall have been already sold ; as well as to institute an action for damages, as far as there are grounds for the same.

7th.—Whoever shall present a petition, in order to obtain a patent of invention, shall be bound to join thereto, sealed up, an exact and detailed description, and signed by him, of the object, or the secret, for which the patent is solicited, together with the necessary plans and drawings ; that description shall be published after the expiration of the term of the patent of invention, whether it be the original term, or a prolonged term ; or even sooner, in case the patent, for any of the causes assigned hereinafter, shall be declared void.

The government, may, nevertheless, defer that publication, if it should be judged necessary, for important reasons.

8th.—A patent of invention shall be declared void, for the following causes :—

(a) When the patentee shall have fraudulently omitted, in the description joined to his petition, to make mention of any part of his secret, or shall have stated it in a false manner.

(b) If

* Note—The above is translated from the *Journal Officiel du Royaume des Pays Bas*. Tome 10. No. 6, printed at Brussels in Dutch and French.

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(b) If it should appear that the object for which a patent has been granted, was already described, prior to the date of the patent, in any work printed and published.

(c) When the patentee shall not have made use of his patent, within the space of two years, reckoning from the date of his patent; unless there have been strong reasons for that delay, of which reasons the government shall judge.

(d) If the person who has obtained a patent of invention, should obtain one subsequently for the same invention in a foreign country.

(e) If it should appear that the invention for which a patent of invention shall have been granted, is in its nature, or in its application, dangerous to the security of the kingdom, or its inhabitants.

9th.—A separate account shall be kept, of the taxes paid by those who obtain patents for inventions; and the produce shall be employed in premiums, or in rewards, for the encouragement of the arts, and of the national manufactures.

10th.—The existing laws and regulations concerning patents of invention, and other similar exclusive rights, are abrogated and rendered null by this present; but, nevertheless, it is to be understood, that those to whom patents of invention have been delivered and granted until this day, shall be maintained in the enjoyment of all their rights.

We command and order that the present law be inserted in the *Official Journal*, and that our ministers, and other authorities whom it concerns, do see strictly to its execution.

Given at Brussels, the 25th January of the year 1817, the fourth of our reign.

Signed by the King, *William*.

(signed) *A. R. Falck*.

Regulation for the execution of the Law of the 25th January 1817, and for the delivery of Patents of Invention, Importation, and Improvement.

ARTICLE I.—A Person who wishes to obtain a patent of invention, importation, or improvement, must deposit with the Recorder of the States of his province, a petition to the King, containing the general object of his petition, his name, christian name, and place of residence, as well as the time for which he wishes to obtain a patent, and the time for which the same object may have already been patented in a foreign country; he shall join thereto under seal, an exact and detailed description, signed by himself, of the object or secret for which he desires to obtain a patent, together with the necessary plans and descriptions, conformably to Article 7, of the law of the 25th January 1817.

2d.—The recorder of the states for the province, shall draw up an attestation on the outside of the packet (Model N° 1.) of the precise date of the deposit of the petition, and other papers joined thereto, and that attestation shall be signed by him, and by the petitioner; to whom a duplicate copy thereof shall be given.

3d.—The government will forward directly, and at the latest within ten days, dating from the day on which the deposit shall have been made, to the Commissary General of Instruction of Arts and Sciences, all petitions for patents of invention, improvement or importation, &c.

4th.—The Commissary General shall present to the King, with his opinion, the petitions for patents of invention, improvement, or importation, &c. when he shall have found that a petition is of such a nature as to be granted. He shall join, with his report, the patent for his Majesty's signature.

5th.—When the King shall judge fit not to grant the petition, or to refer it to the opinion, either of the Royal Institute of the Netherlands, or of the Royal Academy of Sciences and Literature of Brussels, notice thereof shall be given to the petitioner.

6th.—The patent (Model, N° II.) shall contain the description of the invention; it shall define the rights that it gives to the patentee, conformably to Article 6, of the law of the 25th January last, and shall mention expressly, that the government, in granting the patent, guarantees, in no way, either the priority or the merit of the invention, and reserves to itself the right of declaring it void for any of the causes stated in Article 8, of the law. The patent of importation, for an object already patented abroad, shall contain, besides, the express mention that the government does not guarantee the assertion of the petitioner, as to the duration of the patent granted abroad; it shall contain also, the clause prescribed by the Article 5, of the law, that the objects mentioned shall be manufactured in the kingdom.

7th.—A person

Note.—This *Regulation for the execution of the Law*, is translated from a French edition not official; but the body of the law in that French edition being correctly printed after the official copy published at Brussels, there is no reason to doubt the correctness of the part containing the *Regulation*.

7th.—A person who wishes to obtain a prolongation for a patent of five or fifteen years, (Article 4,) must apply to that effect to the Commissary General of Instruction, of Arts and Sciences, who will make his report thereon to the King. These prolongations must also be signed by the King.

8th.—Every proprietor of a patent who, by other new discoveries, shall have improved upon the discovery for which the patent was granted, may obtain a new patent for the exercise of those new means.

9th.—To obtain such a patent, the same forms must be fulfilled, as for the other patents. Respecting the duties to be paid, they will be regulated by the length of time during which the exclusive privilege is to last, and by the importance of the means of improvement.

10.—If any person announces a means of improvement upon an invention already appropriated by a patent, he may obtain a patent for the exclusive use of the said means of improvement; but he shall not be permitted, under any pretext whatsoever, to execute, or cause to be executed, the principal invention, so long as the patent granted for that invention shall not have expired; and reciprocally, the first inventor shall not be permitted to execute alone the new means of improvement. Changes of form, or of proportions, or ornaments of any kind whatsoever, shall not be held as improvements in manufactures.

11.—Proprietors of patents, who may wish to make assignment of their rights, wholly or in part, must first obtain the King's authority so to do. They must, under pain of the assignment being null, cause the same to be registered at the record office of the province; where a certificate shall be executed (conformably to Model N° III.) which shall be immediately transmitted to the Commissary General of Instruction of Arts and Sciences. That certificate shall be recorded in the register which will be hereinafter mentioned.

12th.—In like manner, he or they who become proprietors of a patent, by right of succession, must, before they can enjoy their rights, cause that acquisition to be registered at the record office of the province, where a certificate shall be drawn up (conformably to Model, N° IV.) which shall be immediately transmitted to the Commissary General of Instruction of Arts and Sciences; and that certificate shall be recorded in the register hereinafter to be mentioned.

13th.—At the expiration of the term of patents of invention, or when a patent shall be declared void, for any of the causes provided for in Art. 8. of the law of the 25th January; the Commissary General of Instruction shall take suitable measures for making public, the discoveries and inventions which have been patented.

14th.—If at such expiration, or in consequence of any one of the causes provided for by Art. 8th, the Commissary General of Instruction, should not deem it advisable, for political or commercial reasons, to make public the discovery or invention, he shall make his report thereon to the King, who shall decide.

15th.—The Commissary General of Instruction shall forward the patents for invention, importation, or improvement, granted and signed by the King, to the governor of the province in which the petitioner resides, stating to him the sums to be paid for the patents. The governor shall remit the patents to the petitioners respectively, when they shall have shewn that they have paid to the receiver of the province, the duties fixed by the Table (Tarif.)

16th.—The Duties to be paid for obtaining Patents, are regulated in the following manner:—

For a Patent for five years	- - - - -	150f.
For a Patent for ten years	- - - - -	300 or 400f.
According to the importance of the invention or improvement.		
For a Patent for fifteen years	- - - - -	600 or 750f.
For the transfer, or for the acquisition,	} - - - - -	9f.
by right of succession, of a Patent - }		

17th.—When a patent shall be declared void, for any of the causes mentioned in Art. 8th, of the law of the 25th January, the duties paid for that patent shall be refunded, in proportion to the time the patent had yet to run.

18th.—The Minister of Finances shall transmit annually, to the Commissary General of Instruction, an exact statement of the sums produced by the duties paid for obtaining patents of invention, importation, or improvement. The Commissary General shall propose to the King in what manner to employ those funds, conformably to the meaning of the Article 9th, of the law of the 25th January last.

19th.—A register shall be opened at the office of the Commissary General of Instruction, in which the patents granted shall be inscribed, as well as the certificates of transfer and assignment of right: that register may be consulted by those who desire to take out a patent.

20th.—Notice shall be given in the official journals, of the patents granted, and the names of those who shall have obtained them.

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delivered in by
John Farey, Esq.
8 June 1829.

N^o 1.—MODEL of an attestation of the Deposit of the Papers for a Patent of Invention, of Importation, or of Improvement.

This *Province of* day of the month of 181 at o'clock
Mr. deposited in our hands the present packet, sealed with his seal, which he has informed us contains all the papers descriptive of [state the object] for which he solicits a patent of invention [or improvement or importation] for five, [ten or fifteen] years, as is stated in the petition joined hereto; and the said Mr. has declared to us that he is the inventor [improver or importer] of the said object.
Done at the Record Office of the Province of

N^o 2.—MODEL of a Patent of Invention [Importation or Improvement] established by the Law of the 25th January 1817.

WE, William, by the Grace of God, King of the Netherlands, Prince of Orange Nassau, Grand Duke of Luxembourg, &c.

Having seen the request made by Mr. residing at by which he states that according to the terms of the law of the 25th January 1817, he wishes to obtain a Patent of invention [improvement or importation] for years for [state the invention,] a process of which he has declared himself to be the inventor [or the importer] as appears by the attestation which was drawn up at the time of the deposit of the papers, at the Record Office of the Province of on the day of 181

Having seen the drawings and the descriptive memoir, whereof the tenor and copy is as follows, with the plans;

We grant to the petitioner a patent of invention for the term of years, for [state the invention.]

A.—This patent will give to its possessor the right of making and selling exclusively, throughout the kingdom, during the time fixed for the term of the patent, the objects therein mentioned, or of causing them, to be made, and sold by others, whom he shall authorize to do so.

B.—Of citing before the tribunals those who infringe upon the exclusive right granted to him, and of proceeding against them at law, in order to obtain the confiscation, for his own advantage, of those objects named in the patent which have been made, but not sold, and also of the price obtained for such as have been sold; as well as of instituting an action for damages as far as there are grounds for the same.

But this patent does not in any way guarantee the priority, nor the merit of the invention; or in patents for importation, the truth of the petitioner's assertion as to the existence and duration of the foreign patent, is not in any way guaranteed.

And the present patent may be declared void by us, for any of the causes stated in Art. 8. of the law. (For the patent of importation, all the objects relating to the invention hereinbefore detailed, must be manufactured in the kingdom.)

Done at

N^o 3.—MODEL of Certificate of the Assignment of a Patent of Invention.

This day of the month of in the year 181
Mr. presented himself at our record office, to demand a register of the assignment that he makes to Mr. by a deed executed before the notary public of the whole or part of the patent of invention which was delivered to him the day of 181 for which register the parties interested therein have signed with us, after having paid the duties fixed in the table of duties, respecting the granting of patents.
Done at the Record Office of the Province of the

N^o 4.—MODEL of a Certificate of acquisition of a Patent of Invention, by right of Succession.

This day of the month of in the year 181 Mr.
presented himself at our record office, to demand a register of the acquisition which he has made, as is stated by certificate from the notary, by right of succession, of the whole or part of the patent of invention, which was delivered the day of 181 for to M. deceased.

Which register the party interested has signed with us, after having paid the duties fixed by the table of duties respecting the granting of patents.

Done at the Record Office of the Province of the

Decreed by His Majesty the 26 March 1817.

A correct translation.

(signed) De Geer.

The Secretary for the Department of Instruction of Arts and Sciences.

Appendix (F.)

Appendix (F.)

Austrian Law.

Austrian Law of Patents.

Papers
delivered in by
John Farcy, Esq.
8 June 1829.

IMPERIAL DECREE OF THE 8th DECEMBER 1820.

WE, Francis I. by the grace of God Emperor of Austria, King of Jerusalem, Hungary, Bohemia, Lombardy, &c. &c.

In order to introduce into all the provinces of the Austrian monarchy a uniform system for granting exclusive privileges for discoveries, inventions and improvements in all branches of industry,* and thereby to encourage the spirit of invention, and excite the national activity;—Upon the representation of Our Imperial Board of Commerce, we have judged fit to decree.

CHAPTER 1.

Of the Object of exclusive Privileges, and of the Manner of obtaining them.

§ 1.—ALL new discoveries, inventions and improvements in every branch of industry, made either in the country or in a foreign country, are entitled to obtain an exclusive privilege in the Austrian monarchy, whether the petitioner for the privilege is a native or a foreigner.

§ 2.—Whoever desires to obtain an exclusive privilege for any discovery, invention or improvement in a branch of industry, must present his petition according to the formula, marked (A.) to the *Direction* of the Circle in which he resides. He must therein state the substance of his discovery, invention or improvement; the number of years for which he desires to obtain the privilege, (which term can, in no case, exceed the term of fifteen years) (§ 19.) He must deposit one-half of the duty payable for the patent, according to the regulations stated hereinafter (§ 13–18.) and he must join thereto, sealed up, an accurate description of his discovery, invention or improvement; in which description the following qualifications will be required:—

(a) The description must be written in the German language, or in the language used for business in the province in which the petition is made.

(b) It must be drawn up so clearly that every person who understands the subject, may be able to manufacture the object, by means of the description, without being obliged to supply any further inventions, additions or improvements.

(c) That which is new, and which consequently constitutes the object of the privilege, must be accurately distinguished and set forth in the description.

(d) The discovery, invention or improvement must be clearly and distinctly described, and without any ambiguities that can mislead, or that are contrary to the object stated at (b.)

(e) Nothing must be kept secret, either in the materials or the method of execution; therefore more expensive means, or means not producing an entirely similar effect, must not be described; nor must any manipulations, which are essential to the success of the operation be concealed. If it is practicable, drawings and models are to be added, for the better understanding of the description, but these are not strictly required, if the object can be made sufficiently clear by the description alone, according to the requisites stated at (b.)

§ 3. The *Direction* of the Circle must deliver to the petitioner for the privilege, a receipt or certificate of the deposits above mentioned, according to the annexed formula (B.); in which must be recorded the name and residence of the petitioner, and the day and hour of the deposit; the acknowledgment of the payment of the duty; and the declaration of the discovery, invention or improvement as notified in substance in the petition.

§ 4. *The priority* of the discovery, invention or improvement set forth, shall take effect from that day and that hour. That is; every objection thereto of a similar discovery, invention or improvement being made or practised, if *after* that date, shall be held null, and cannot

* *Note.*—The term *Industry*, is used in foreign commercial language, for every kind of manufacture.

Note.—The above was originally translated from a French translation not official, but has since been amended and made correct, by revision with an original in German, exhibited to the Committee by Mr. Hawkins; and also by comparison with the translation into English, presented by Mr. H. to the Committee.

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cannot impugn or set aside the novelty of the discovery, invention or improvement, which is regularly notified and described by the petitioner for the privilege.

§ 5.—The Direction of the Circle shall write on the cover of the sealed description, immediately upon the receipt thereof, the name and residence of the petitioner for the privilege, the day and hour of the deposit, the amount of the tax paid, and the declaration of the discovery, invention or improvement notified in substance in the petition, conformably to the annexed formula (C.) under the signature of the petitioner; and shall also transmit to the government of the province, together with the petition, without delay, and at the most within three days, the said description, without breaking the seal thereof, and also shall forward the tax received, to the government of the province by the usual means.

§ 6.—The government of the province shall not in any manner enter into the question of the novelty, or utility, of the discovery, invention or improvement; but shall only decide whether the discovery, invention or improvement notified in substance in the petition, is hurtful in any public view, or is contrary to the laws of the country. And it shall make a report thereon without delay, and at the most within eight days, to the imperial board, appointed for the management of commercial affairs, and shall add thereto, the petition, and the sealed description with the attestation of the Direction of the Circle, without breaking the seal thereof, and on the cover of which it has only to add, the day of the receipt, and of the dispatch of the same, to the imperial board of commerce.

§ 7.—The government of the province shall make further examinations and inquiries, in those cases only where doubts shall arise, whether or not the discovery, invention or improvement notified in substance in the petition, is hurtful or contrary to the laws, and from considerations of State, which may require such inquiries; and even in those cases, the preliminary notification must always be made to the imperial board appointed for the management of commercial affairs, within eight days.

§ 8.—The government of the province shall be permitted to open the sealed description delivered in by the petitioner for privilege, in cases only of such objects as relate to sanitary regulations, and upon which, according to the laws of the country, an accurate preliminary examination by the faculty of medicine will be required. It is to be understood of course, that when means or processes, relating to objects, which are not notified in the petition for a privilege, but which are explained in the sealed description, shall militate against police or sanitary regulations, or against the interests of the State in general, then their use and practice cannot be permitted under an exclusive privilege, any more than without it, and that the grant of the privilege becomes null of itself in such cases.

§ 9.—The imperial board appointed for the management of commercial affairs, must deliver to us their representation on the petitions for privileges, which arrive from the governments of the provinces, being duly provided with the above mentioned requisites; and must take charge of preparing the deeds for such patents, with the necessary precautions and clauses, according to the annexed formula (D.) and of causing the same to be delivered to the privileged persons, together with the publication usual hitherto.

CHAPTER 2.

Of the Advantages and Rights conferred by exclusive Privileges.

§ 10.—THE exclusive privilege secures and guarantees to the privileged person, the exclusive use of his invention, discovery or improvement, in that manner in which it is set forth in the description he has delivered, and during the term of years which his privilege is to last.

§ 11.—The privileged person has a right to erect all necessary workshops, and to take into them all kinds of assistants, and work people, who may be necessary for the full practice of the object of his privilege, to the greatest extension that he may chuse; consequently, to form establishments and depôts all over the monarchy, for the manufacture and sale of the object of his privilege, and to empower others to practise his invention, under the protection of his privilege; to take such partners as he may chuse, in order to increase the profits of his invention to any scale; to dispose of his privilege itself; to bequeath it, to sell it, to let it out, or assign it away at his pleasure; and also to take out a privilege in a foreign country for his invention.

§ 12.—A privilege for an improvement, or change, in an invention already privileged, is confined, solely and only to the particular improvement or change itself, and does not give to the privileged improver, or changer, any right to the other parts of the invention already privileged, or of a method or process already known; on the other hand the original inventor must not make use of the privileged improvement, or change, made by another person, unless he has agreed for the same with that person.

CHAPTER 3.

Of the Taxes upon Privileges.

§ 13.—THE duties upon privileges are to be paid in proportion to the time granted for their duration (§ 14,) (which, however, must not exceed 15 years) (§ 19); and the petitioner for a privilege must determine for himself, for how many years, within the limits of the longest term, he desires to obtain the privilege.

§ 14.—For

§ 14.—For every year of the term of a privilege, whether it is granted for a discovery, or an invention, or an improvement, a privilege tax of 10 florins convention money, is to be paid during the first 5 years; altogether, therefore, for all the 5 years 50 fl. c. m.

For the 6th year	-	-	-	-	-	15
— 7th	-	-	-	-	-	20
— 8th	-	-	-	-	-	25
— 9th	-	-	-	-	-	30
— 10th	-	-	-	-	-	35
— 11th	-	-	-	-	-	40
— 12th	-	-	-	-	-	45
— 13th	-	-	-	-	-	50
— 14th	-	-	-	-	-	55
— 15th	-	-	-	-	-	60

Altogether therefore for the longest term of 15 years - - *425 fl. c. m. to be paid.

§ 15.—One half of the privilege-tax for the whole term, must be paid as is directed in § 2, at the time of making the petition for the privilege; the other half is to be paid at the beginning of each year in as many yearly rates as the years for which the privilege was taken; under pain of its being annulled.

§ 16.—In order to facilitate to inventors the obtaining of privileges, for the purposes of trying experiments upon their inventions, any one who has originally taken a privilege for a term less than 15 years, may, before the expiration of that privilege, obtain a prolongation thereof, (at the most, to a term of 15 years) on condition of paying for the prolongation of the privilege, after the rate provided by the scale of taxes, one half on asking for the prolongation, and the other half at the beginning of each of the prolonged years, in as many yearly rates, as the prolongation lasts, under pain of forfeiture of the prolongation.

§ 17.—Every tax paid, shall be considered as forfeited, and no claim can be made to have it returned, even though circumstances arise afterwards, which cause a privilege to become void; unless the State, upon public considerations, should find it expedient to annul a privilege, or not to grant it, in which case the duty paid is to be refunded.

§ 18.—Except the above-mentioned tax, (together with an *expedition tax* of 3 florins convention money for preparing each patent deed, and a stamp tax thereon of 7 florins convention money) the privileged person has no other tax whatever, nor fees or office expenses to pay, under any pretext whatsoever, for obtaining the grant of the privilege; but the patent deeds shall be forthwith granted him *ex officio*, like all other decrees.

CHAPTER 4.

Of the commencement, duration, and extent of Exclusive Privileges; of the manner of publication, and of their extinction.

§ 19.—THE longest term for privileges, as stated in § 2 and § 13, is fixed at 15 years.

§ 20.—The term of a privilege begins from the date of the patent deeds; nevertheless the efficacy of the privilege, in respect to the punishment of illegal imitations of the privileged object, can only begin from the day of the announcement of the privilege in the public papers.

§ 21.—The force of the privilege extends, without exception, throughout the whole monarchy.

§ 22.—Every privilege must be drawn up in three patent deeds; the first to be in force for all the hereditary dominions, excepting Hungary and Transylvania; the second for Hungary; and the third for Transylvania.

§ 23.—Privileges become void:—

(a) If the accurate description of the discovery, invention or improvement, for which the privilege was petitioned, is wanting in the requisites above stated in § 2. (a—e) or in only one of those requisites.

(b) If any one proves legally, that the privileged discovery, invention or improvement, could not be considered new in the monarchy, previous to the date of the official certificate drawn up according to the regulations hereinafter stated in § 27. (d).

(c) If the possessor of a privilege in force for a discovery, invention or improvement, proves that the privilege subsequently granted, is identically the same as his own discovery, invention or improvement, which was regularly described and privileged at an earlier date.

(d) If the privileged person has not begun to practise his discovery, invention or improvement within the term of one year, from the delivery of his privilege, whether he is a native or a foreigner.

(e) If

* Note.—This is equivalent to £. 42. 10 s. of sterling money.

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(e) If he discontinues that practice for the space of a year, during the term of the privilege, without showing sufficient grounds for the same.

(f) If the second half of the tax is not paid, in the above stated annual rates.

(g) Lastly, by the expiration of the original term for which the privilege was granted, or of the prolongation subsequently obtained. It is to be understood, as a matter of course, that these causes for the cessation of a privilege, apply as well to any one who acquires a privilege (by transfer,) as to the original privileged person (patentee.) After the extinction of a privilege, the use of the discovery, invention or improvement, for which the privilege was granted, will become open to every one.

CHAPTER 5.

Of the Registry of Privileges.

§. 24.—IN order that every person who desires to take out a privilege, may be able for his greater security, to inspect the privileges already granted, a register shall be opened, in all the governments of the provinces of the monarchy; in which all the privileges shall be entered, as they have been granted, together with the declaration of the persons who shall have obtained them, their residences, the dates of the official certificates, and of the patent deeds, and the time when they will expire; and in which register a suitable margin is to be left open, for remarks upon the state of the subsequent practice, and upon the changes which take place in the possession of the privileges. The chief register shall be kept by the imperial board appointed for the management of commercial affairs.

§ 25.—When the privilege is transferred to another, whether by sale, exchange, gift, inheritance, lease, or any other alienation, authentic notice thereof must be given to the government of the province; and that government must record the change of possession on the back of the patent deed, and ratify it, and give notice thereof to the imperial board appointed for the management of commercial affairs, in order that the change may be recorded in the registers.

§ 26.—Concerning the revision of the exclusive privileges granted hitherto, (and of which the possessors remain in possession, in the same manner and under the same conditions as they were granted to them) a further regulation will be issued.

CHAPTER 6.

Of the Proceedings in case of Disputes, and of the Penalties sanctioned by the new System.

§ 27.—FOR the prevention and uniform settlement of disputes, the following regulations are enacted:—

As the privilege is founded upon the description of the discovery, invention or improvement which is delivered by the possessor thereof (§ 10.); in case of disputes, the discovery, invention or improvement shall be judged according to the manner in which it is set forth in that description.

(a) Every new finding out of a process in industry, which, although practised in former times, has been since entirely lost, or which although still practised in foreign countries, is unknown in the monarchy, shall be held a discovery.

(b) Every production of a new object by new means; or of a new object by means already known; or the production of an object already known, by means different from those which have hitherto been used for that object, shall be held an invention.

(c) Every addition of a preparation, arrangement, or method of working, to a process, already known or privileged, by which more complete success, or greater economy shall be attained in the result of that process, or in its mode of operation and application, shall be held an improvement.

(d) Every discovery, invention, improvement, or change, shall be held as new, if it is not known in the monarchy, either in practice, or by a description of it contained in a work publicly printed. But the novelty of a discovery, invention or improvement, shall not be called in question, on account of its being described in a work publicly printed, unless that description is so accurate and clear, that any person acquainted with the subject, can, by means of that description, manufacture the object, or practise the process for which the privilege has been granted.

§ 28. The question, whether a privilege which has been granted, ought to be annulled, for public considerations; or on account of the practice of the same being neglected; or from the possessor of the privilege having failed to fulfil, or having infringed, the conditions of the grant, shall be decided by the political authorities, according to their jurisdictions; with the reservation of appeal to the higher authorities,

§ 29. The

§ 29. The decisions upon the reality of an infringement or encroachment; upon the application of the legal penalty; upon the compensation for the damage proved by either party; as well as upon a contest as to the rightful property in a privilege, whether that contest arise as to the priority of the discovery, invention or improvement, or upon a private claim of right, rest with the ordinary Judges, and are to be made in a legal manner, according to the terms of the foregoing law.

§ 30.—When the privileged person believes that any one is making an infringement upon his right of privilege, or has encroached upon the same, he is authorized to require of the judge who has jurisdiction in the place where the infringement is committed, or to whose district the infringer belongs (if the latter can be found), to put a stop to the further imitation of the object of his privilege, by the illegal imitator of the same; and also to require the immediate seizure of the articles so imitated, whether they are in the possession of the imitator himself, or of a third person, or whether they have been brought in from foreign countries; whereupon the judge whom it concerns, must exercise his authority without delay, to maintain the privilege.

§ 31.—Infringements on privileges shall be visited with a penalty of 100 ducats in specie, of which the half shall be paid to the privileged person, and the other half to the fund for the poor of the place, where judgment shall have been first given, besides the confiscation, for the benefit of the privileged person, of the objects imitated, in infringement of the privilege.

Given at our imperial palace and metropolis of Vienna, the 8th day of December, in the year of our Lord 1820, and in the 29th year of our reign.

(Imperial Seal)

Signed by the Emperor

Francis.

Francis Count Saurau, Chief Counsellor.

Proc. Count Lazanzky.

Pet. Count Goes.

Joh. Nep. Baron Geisslern.

According to his Imperial Royal Apostolical Majesty's high special command,

John Baron Metzburg.

Formula referred to in the Austrian Law of the 8th December 1820.

FORMULA A.

TO the honourable, &c. [here state the Direction of the Circle to which application is made] the petition of N. N. certifies that [state the christian name, surname, business, and place of residence of the petitioner, or petitioners, for a privilege] humbly sheweth, [or show] that he [or they] has [or have] made a new discovery [invention or improvement] which in substance consists in [here follows the definition of the same]; an accurate description of which is joined herewith, according to the directions in section 2, of the imperial decree of the 8th Dec. 1820. [If drawings, models, patterns, &c. are at the same time delivered in, the exact number of the parts or pieces must be stated in this place.] This discovery [invention or improvement] thus duly and regularly set forth, and described, the above-named, and hereafter subscribed, petitioner [or petitioners] considers [or consider] to the best of his [or their] knowledge, and in his [or their] conscience [or consciences] to be new in the Austrian monarchy, according to the regulations of section 27 of the above-mentioned imperial decree, and consequently that it is legally qualified for obtaining an exclusive privilege, at his [or their] peril and responsibility. He [or they] humbly petitions [or petition] for such a privilege for the defined discovery, [invention or improvement,] in the manner that the same is set forth in the annexed sealed description, under the legal clauses and conditions, for the space of years. For which purpose the half of the privilege tax assigned to be paid by virtue of section 14 of the said imperial decree, is paid, with florins, convention money; and the preparation [or issue] of the official certificate for securing his [or their] claim of priority is required.

[Place, year and day of the drawing up of this notice.]

Signature [or signatures.]

FORMULA B.

THE under named department [office] certifies hereby, that this day [day, month, year] at o'clock before [or after] noon, N. N. [here state the christian name, surname, business, and place of residence of the petitioner or petitioners] appeared in this department, and presented, together with the regular petition or declaration, a sealed packet, in which his [or their] alledged new discovery [invention or improvement] is described, and which according to the said petition, is said to consist in substance in [here copy the definition literally as it is stated in the petition; also the list of the annexed drawings, models, patterns, &c.] and he [or they] has [or have] paid for an exclusive privilege of years, the half of the privilege tax for that term, as assigned to be paid by virtue of section 14 of the imperial decree of the 8th December 1820, with florins convention money.

Given the

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FORMULA C.

Indorsement by the Direction of the Circle, on the outside of the sealed Packet.

Description of the alledged new discovery [invention or improvement] made by N. N. [here state the christian name, surname, business, and place of residence] and which consists in substance in [here give the definition in the words of the petition.]

Received in the [year, month, day, hour]

Official signatures.

*Signature [or signatures]
of the petitioner [or petitioners] for the privilege.*

Beneath the above indorsement, the date of the delivery to the government of the province must be added, by that government; and also the date of the dispatch to the court;

Note.—*Any delay, however trifling, or any neglect in forwarding these packets, will be severely reprehended.*

FORMULA D.

WHEREAS N. N. [here state the christian name, surname, business and place of residence of the petitioner or petitioners] has [or have] most humbly represented, that he [or they] has [or have] made a discovery [invention or improvement] which to the best of his [or their] knowledge, and in his [or their] conscience [or consciences] is new in the Austrian dominions; consisting in [here give the definition from the petition]; for which discovery, [invention or improvement] he [or they] solicits [or solicit] an exclusive privilege for the term of _____ years. All the formalities ordained in our decree of the 8th December 1820, having been complied with, we have been graciously pleased to grant to N. N. his [or their] heirs and assigns, for his [or their] said discovery [invention or improvement] an exclusive privilege for _____ consecutive years, throughout the whole extent of our monarchy, on the conditions contained in our decree of the 8th December 1820; which conditions are—

1st.—That if in the sealed accurate description of this discovery, (invention or improvement) (against every expectation,) there should be contained any means and processes, which are not notified in the above-mentioned representation, nor in the definition of the substance of the said discovery, (invention or improvement,) and which are contrary to the laws of the land, then the application and practice of the same cannot be permitted under the exclusive privilege, any more than without one, and the grant of this privilege is in such case, of itself, null and void.

2d.—That the privilege becomes void, if it is established by legal proof that the said description is wanting essentially, in any of the qualifications legally required therein.

3d.—That if any one can show, by legal proceedings, that the privileged discovery (invention or improvement) could not be considered new in our monarchy, before the date of the issue of the certificate officially given to the petitioner, according to the regulations decreed for that case, in our decree of 8th Dec. 1820, then such privilege shall be considered void, or rather as not granted.

4th.—That the privilege is to be considered void, or rather as not granted, if the proprietor of a previous privilege can show that the newly privileged discovery (invention or improvement) is identically the same as his own discovery, (invention or improvement,) for which he had obtained a certificate, or for which he had obtained a privilege at an earlier date.

5th.—That the privilege is void, if the privileged person (or persons) within the term of one year after the present date, shall not have begun to practice his (or their) discovery (invention or improvement) or if he (or they) shall leave off that practice for one entire year, during the time the privilege lasts, without showing good and sufficient reason for so doing.

6th.—That the privilege is void, and not in force, if the half of the privilege tax, remaining to be paid, is not cleared at the prescribed terms.

7th.—That at the expiration of the lawful term of the privilege, every one shall be at liberty to make use of the said discovery, (invention or improvement.)

Now if the legal conditions are faithfully complied with, he the said N. N. [or they] shall not only enjoy the privilege most graciously granted to him [or them], but we ordain at the same time, that during the term of _____ years, commencing from the day of publication of this patent, every one, throughout the whole monarchy, except he [or they] or his [or their] heirs and assigns, shall abstain from practising the discovery, [invention or improvement] set forth and described by him [or them], under pain of confiscation of the objects made in imitation of the privileged objects, which imitated objects shall be forfeited for the benefit of N. N. together with a fine of 100 ducats in specie, for every transgression; half of which shall go to the fund for the poor of the place where judgment was first given, the other half to N. N.; and that fine shall be rigorously exacted by the Exchequer court, established in the province where the infringement takes place. Moreover the infringer of this privilege, shall incur our special imperial displeasure; and besides, N. N. shall be authorized to sue him for damages, for all the injury he has sustained, and can prove.

We issue our express commands to the authorities whom it concerns, to watch over the maintenance of this privilege, and of the conditions attached to it.

In witness whereof,

(L. S.) Francis.

Here follow the usual signatures.

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Appendix (F 1.)

Paper
delivered in by
Mr. J. I. Hawkins,
5 June 1829.

AN ACCOUNT of the Number of PATENTS obtained in *England, France and Austria*, as published in the "Polytechnische Jahrbücher" at *Vienna*. Communicated by Mr. Hawkins.

	England.	France.	Austria.
1821 - - -	106	179	107
1822 - - -	115	135	167
1823 - - -	136	153	197
1824 - - -	180	164	236
1825 - - -	247	246	194
1826 - - -	130	214	198
In Six years - - -	914	1,091	1,099
Yearly average - - -	152	182	183

AVERAGE in England, from 1818 to 1826 - - 138.

Appendix (G.)

Appendix (G.)

Spanish Law.

Papers
delivered in by
John Farey, Esq.
8 June 1829.

Spanish Law of Patents.

LAW IN FORCE UNDER THE CONSTITUTIONAL
GOVERNMENT.

Law decreed by the Cortes, the 2d October 1820, and sanctioned by the King, the 14th of the same month; but annulled by him in 1823.

FERDINAND VII. by the grace of God, and the Constitution of the Spanish monarchy, King of Spain: To all to whom these presents shall come; BE it known, That the Cortes have decreed, and that We sanction the following Decree:—

The Cortes, after having observed all the formalities prescribed by the Constitution, have decreed as follows:—

ARTICLE 1st.—Whosoever invents, improves, or imports, a new branch of industry, has a right of property thereto, for the time and under the conditions determined by the present law.

2d.—The government does not undertake to examine if the inventions, improvements or importations are useful or not, but only if they are contrary to the laws, to the public safety, to good morals, or to the ordinances or regulations; and if they are not, government will not refuse its protection to him who believes himself to be the inventor, improver or importer.

3d.—The person who invents, perfects, improves or imports any new branch of industry, if he desires that the government shall ensure to him the property thereof, shall remit to the municipality of his place of residence, or to the political chief of his province, an exact description, accompanied by drawings, models, and all that he shall judge necessary for the explanation of the object that he proposes, the whole signed by him; and the said authorities shall be obliged to give him an attestation, relating the whole according to the form, N° 1.

4th.—The local authority shall be obliged to forward that deed, with all the documents belonging thereto, to the political chief of the province; and the latter shall forward the same to the secretary of government, with the least delay possible; they shall be responsible for any injury which may result from delay.

5th.—The inventor, improver or importer, at the same time that he demands the protection of the government, by presenting the documents stated in Article 3d, shall remit 1000 reals in the first case, 600 in the second, and 500 in the third case: these sums shall pass to the different treasuries of the provinces.

6th.—From the time that he shall have received the attestation mentioned in Article 3d, and made the deposit mentioned in Article 5th, the inventor, perfecter, or importer established in the provinces beyond seas, may commence the practice of his invention, perfection or importation, without danger from having still to procure the certificate of government.

7th.—The secretary of government is obliged to send to the inventor, perfecter or importer, the certificate concerning him, according to the model, N° 2. through the medium of the political chief of the municipality of the place, without its being necessary previously to make any other verification or examination, than those whereof mention is made in Article 2d.

8th.—This certificate shall contain an exact copy of the documents and drawings presented by the petitioner, and the description of the models.

9th.—At the time that the inventor, perfecter or improver receives from the municipality, or from the hands of the political chief, the certificate sent by the head of the government, he shall pay a further sum, equal to that which he has paid, at the time of making the petition for the said certificate. These sums shall pass to the respective treasuries of the provinces, the same as has been stated for those in Article 5th.

10th.—The

Note.—The above is translated from a French translation, not official.

10th.—The original deeds (or documents) of inventions, improvements or importations being complete, shall be transmitted to the General Direction of Encouragement of Industry of the kingdom, and from thence to the proper quarter; and the said deeds or documents shall remain deposited there, registered in numerical order, according to their dates, in a book which shall be opened for that purpose.

11th.—In cases where, in the judgment of the inventor, political or commercial reasons require his discovery to be kept secret, he shall represent his motives by petition to the chief of the General Direction of Encouragement of the kingdom, or to the person that the government shall appoint, who shall in his presence, either by the hand of the petitioner, or of a person in his confidence, transcribe the descriptions upon a particular register, which shall remain shut, and sealed, all the time that the secret is to be kept; and there shall be inscribed upon the cover, the name of the inventor, the date, and the objects contained in the packet. The inventor shall receive a copy of this act of registry, and by means thereof, he shall have forwarded to him, by the secretary of government, the certificate which insures to him the property in his invention.

12th.—The chief of the General Direction of Encouragement of the kingdom, shall take care that every invention, improvement or importation, which the government shall have committed to his care, shall be immediately announced publicly, in the Gazette, in order that all persons may become acquainted with it; and besides, he shall be obliged to communicate to any who shall require it, the catalogue and the register of all the certificates given, as also the indorsements on the covers of secret inventions; in order that any person may judge whether he shall determine upon asking for a certificate for any invention, improvement, or importation, of which he may believe himself to be the author.

13th.—Certificates of invention shall be in force and activity during ten years, those for improvement during six years, and those for importation during five years, reckoning from the date of the certificate; and except on a proposition by the government, approved by the Cortes, they shall not exceed those terms; and they shall never be extended beyond fifteen years for the first, ten years for the second, and six years for the third.

14th.—Every inventor has a right to improve upon his own invention, by following the rules and formalities prescribed in respect to improvements.

15th.—Every person has a right to improve upon the invention of any other, but not to use the original invention, without previously entering into agreement with the inventor thereof; and reciprocally, the inventor shall not use the improvements and ameliorations made by another, without entering into agreement with their author.

16th.—By an *inventor* is understood a person who makes, for the first time, a thing which was not made before that time, or was made in another way; and by an *improver*, a person who adds to inventions, or takes away from them, or changes some essential parts of them, in order to render them more useful. Therefore, a person who imagines or contrives a machine, apparatus, or process hitherto unknown, is an *inventor*; also, he who shall discover a new application for inventions, mechanism, or processes already known, is an *inventor*; but he who applies things already known, to mechanism or processes already known, is not held an inventor.

17th.—In case of contest respecting inventions, if two discoveries are absolutely similar, that which shall have been first presented to the authorities of the place or province, shall have the preference; but if they are different, then the second shall be considered as an improvement, without paying for that, any new tax.

18th.—Certificates of invention, improvement or importation, shall not be allowed for forms, nor for proportions which do not constitute the essence of the thing, nor to ornaments of any kind whatsoever.

19th.—The proprietor of an invention, improvement or importation, may transfer his right, wholly or in part; he may enter into partnerships, sell, exchange, or contract, conformably to the rules established by the law of contracts.

20th.—The proprietor of an invention, improvement or importation, has a right to sue before the courts of civil law, all those who interfere with him in the exclusive enjoyment of his property.

21st.—The certificate given by the secretary for government, shall be the title of the inventor, or improver or importer, to his property; and the descriptions, plans, models, or other things which he shall have presented, shall be adduced in testimony, for or against him.

22d.—The penalties that the courts shall inflict, upon either plaintiffs or defendants, shall be limited to the costs of the action, and compensation for the injury sustained, when there shall

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shall have been no dishonesty; and to the costs of the action, and damages equal to four times the amount of the injury sustained, when the plaintiff, or defendant, shall have acted dishonestly.

23d.—Privileges granted before this day, for inventions improvements or importations, shall enjoy the protection of the present decree, until the expiration of the term therein fixed, dating from the grant of the same; but the proprietors of those privileges must go through the formalities herein prescribed, and shall obtain the certificate which applies to their case, without paying any thing for it.

24th.—Inventors, improvers, or importers, cease to be considered as proprietors,—first, if they give up their rights for the advantage of the public; 2d, if they allow six months to elapse before taking out a certificate; 3d, if they allow two years to elapse without practising their invention, improvement or importation.

25th.—Any person who is engaged in putting in execution an invention, or improvement of any kind, and who, being obliged to employ agents for that purpose, or to make trials in public, or from any other cause, is afraid that he may be forestalled in his demand for the property of his invention, may lodge in the hands of the political chief of the province, a record of his ideas, so drawn up, as to give a clear idea of their object, and then the political chief (without demanding any fee) shall give him an attestation, or certificate, for the same, and shall prescribe the time necessary for the execution of the plans, which time shall not exceed six months. During the course of those six months, the petitioner shall determine, whether or not, to solicit his patent, and no other person shall be allowed to forestal him in his demand, for the property of his invention.

Madrid, the 2d October 1820.

The Count de Toreno, President.

Jean Manuel Subrié, Deputy Secretary.

Joseph Marie Couto, Deputy Secretary.

In consequence, we command all tribunals, justices, chiefs, governors and other authorities, civil, military and ecclesiastical, of all classes and dignities, to observe and cause to be observed, accomplished and executed, the present law in all its parts. You will look to its accomplishment, and take care to have it printed, published and circulated; and is signed by the King's hand.

At the Palace, the 14th October 1820.

à Don Augustin Arguelles.

Note.—The above law is translated from a French edition, not official. The translator has not been able to procure an official copy, as they are become scarce since the law was annulled. The abrogation was made in 1823, in common with all the acts of the constitutional governments of Spain, as follows:

CLAUSE in a Decree issued by Ferdinand VII. dated 1st October 1823.

* 1st.—All the acts of the government, called constitutional, of whatever class and condition, which have governed my subjects from the 7th March 1820 to this day 1st October 1823, are null, declaring, as I do declare, that during all that time, I have not been free, but have been obliged to sanction laws, decrees and regulations which were planned and issued against my will, by that government.

Signed by the Royal hand.

Port Santa Maria, 1st October 1823.

A. D. Victor Saez.

The

* This Clause is translated from the 7th volume of the official collection of the Royal Decrees, entitled, *Decretos y resoluciones de la Junta Provisional del Reino*, and those issued by his Majesty after he was freed from the tyrannical revolutionary power, &c. &c.

The King of Spain afterwards enacted a new law of Patents, which is as follows :

SPANISH LAW of PATENTS now in force, enacted by King Ferdinand VII.
March 27th, 1826.

ACT OF STATE.

Royal Decree, establishing the rules, and the order, according to which exclusive privileges are to be granted for the invention, introduction, importation, or improvement of objects relating to the useful arts.

SEEING that it is a natural means of improving *industry** and the arts, to facilitate the multiplication and improvement of machines, instruments, works of art, apparatus, and scientific and mechanical processes and methods; and that those means of production cannot be looked for, unless their authors, introducers and improvers are made secure in the property, and enjoyment, of the results of their ingenuity, and application, by means of legal enactments, which, by reconciling that equal protection which ought to be maintained between private interests and the public industry, shall shield the former from usurpation, and shall prevent the evil which would result to the latter, from the concealment, and consequent monopoly, of those inventions which are intended for its advantage, I have thought fit to establish the uniform regulations and order, according to which, henceforth, exclusive privileges for the invention, introduction and improvement of objects relating to the useful arts, of all kinds whatever, are to be granted; and having heard upon the subject the *Junta for the Encouragement of the Wealth of the Kingdom*, and the advice of my Council of State, to which advice I have conformed, I hold it good to resolve, and do resolve, that the following Articles shall be observed and kept :

ARTICLE 1st.—Any person, of whatever condition or country, who proposes to establish, or shall establish any machine, apparatus, instrument, or a mechanical or chemical process or operation, which may be wholly or in part new, or which may not have been established in the same manner, and form, in these kingdoms, shall have an exclusive property therein and use thereof, in the whole of the said invention, or in that part thereof which shall not have been before practised in these kingdoms, under the rules and conditions which are hereinafter laid down, subject nevertheless to the laws, the royal ordinances, and the regulations and edicts of the police.

2d.—For securing the exclusive property to the party interested, a *Royal Patent of Privilege* shall be issued to him, without previous examination of the novelty or utility of the object, and without the concession of the grant being considered in any way as a recognition of its novelty or utility, and the party interested shall remain subject to the result, according to the conditions laid down hereinafter in this royal decree.

3d.—Royal patents of privilege shall be issued for 5, 10, or 15 years, at the choice of the parties, in case they solicit them for objects of their own invention; but only for five years, if they are solicited for importations from foreign countries; it being understood that the privilege granted for these last, which shall be called for introduction, must be for executing and putting in practice some invention in these kingdoms, but not for bringing in articles ready made from abroad, as in such case they shall be subject to the dispositions of the tariff and ordinances respecting the entry of merchandize and goods from abroad.

4th.—A privilege granted for five years may be prolonged for five more, on good cause being shewn for the same; those granted for ten and fifteen years cannot be prolonged.

5th.—Shall be held a subject for *patent of invention* that which is not practised in Spain, nor in any foreign country; and that which is not practised in Spain, but is practised abroad, shall be a subject for *patent of introduction*. Nevertheless, all those inventions, of which models or descriptions, in the Spanish language, are lodged in the *Royal Conservatory of Arts*, cannot be a subject of *privilege*, unless three years have elapsed since their entry, without their being put in practice, in which case a privilege of *introduction* may be granted for the same, for five years only.

6th.—The parties interested must solicit the *Royal Patent of Privilege*, either by themselves, or by an agent, by means of a memorial drawn up according to the Model N° I., and delivered to the *Intendant* of the province in which they reside, or they may, in all cases, present it direct to the *Intendant* of Madrid, if they choose.

7th.—The memorial must be accompanied by—1st. A representation to my royal person, written on large sized quarto paper stamped, expressing the object of the privilege, whether it

Note.—The above is translated from the 11th volume of the official collection of the Royal Decrees of Spain, in small quarto, entitled, *Decretos del Rey nuestro Señor Don Fernando VII, y reales ordenes, &c. &c.* from the 1st of January to the end of December 1826, by Don Josef Maria de Nieva. Printed by order of his Majesty. Madrid, at the Royal Press, 1827.

* The word *industry* is used here in the same sense as in the other foreign laws; viz. as a general term for all kinds of *manufactures*.

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it is the invention of the petitioner, or whether it is brought from a foreign country, and the time of duration that is solicited, conformably to Article 3. This representation shall be drawn up literally according to model N° 2. Not more than one invention may be introduced into the same representation; 2d. A plan or model, with the description and explanation of the invention, specifying what is the peculiar mechanism or process which is presented therein, as not having been hitherto practised; the whole being stated with the greatest precision and clearness, so that there may be, at no time, any doubt as to the identity of the invention, and of that peculiarity which is presented as hitherto unpractised in that form; on these conditions alone can the privilege be granted.

8th.—The models must be delivered in a box, closed and sealed, and the same for the plans, descriptions, and papers of explanations, or else they must be put up in paper and sealed. In either case a title or indorsement must be put to the same, in the terms of model, N° 3.

9th.—The *Intendant* shall write under that indorsement *presented*, and shall sign it with his cypher, causing the box or packet to be sealed, and giving to the interested parties, a certificate of the deposit; also a dispatch, with which he remits it to my Secretary of State, or to persons at his office; in order that the interested parties, or some person in their name, may take charge of the whole.

10th.—When I hold it good to grant the royal patent of privilege, the said documents shall be forwarded to my supreme *Council of State*, who are now charged with the affairs formerly examined by the *General Junta of Commerce, Coinage and Mines*, and there the boxes and packets shall be opened; and the documents prescribed by Article 7, being found to be therein, the royal patent of privilege, suitable for the case, shall be issued, drawn up according to model, N° 4.

11th.—Before that issue being made, the parties must present a receipt, certifying that they have already paid into the *Royal Conservatory of Arts*, the following duties:

For a privilege of 5 years	-	-	-	1000	reals. vellon.	=	£.10	sterling.
For - - - 10 years	-	-	-	3000	-	-	£.30.	
For - - - 15 -	-	-	-	6000	-	-	£.60.	
For a privilege of introduction or (importation)	3000	-	-	-	-	-	£.30.	

And in addition 80 reals (16s.) shall be paid for the costs of issuing the royal patent.

12th.—The patent being issued, the documents inclosed and sealed as aforesaid shall be remitted to the *Royal Conservatory of Arts*, and there they shall remain deposited in an apartment destined for that purpose, and shall not be opened except in case of litigation, and by virtue of the official order of a competent judge.

13th.—The grants of patent privileges shall be published in the Madrid Gazette.

14th.—In accordance with the provisions of the Articles 6th and 21st, of the royal ordinance of 1824, by which a *Royal Conservatory of Arts* was created, there shall be kept in that establishment a register, in which all the royal patents of privilege that are issued, shall be entered by order of dates, expressing the date, the names, surnames, and residences of the parties interested, the object of the privilege, and the term of its duration. That register shall be shewn to all persons applying to inspect the same.

15th.—The possessor of a privilege shall enjoy the use, and exclusive property, of the invention for which it was granted (without its being permitted to any one to execute or practise it without his consent,) either for the whole, or for that part which he has declared new, and not before practised in these kingdoms, after the manner in which he has presented it in the model, plan and description, which he has deposited, in order to be adduced in proof at any time.

16th.—The proprietorship (*propiedad*) shall date from the day and hour of the presentation of the documents to the *Intendant*; and in case two or more persons shall have solicited a privilege for the same invention, his privilege alone shall be valid, who first presented those documents.

17th.—The right conferred by the privilege may be transferred, given, sold or exchanged, and left by will, the same as any other personal property.

18th.—Every transfer must be made by a public deed, stating, whether the transfer of the right extends to all the kingdom, or only for one or more provinces, or for particular towns and districts; also, whether the transfer or renunciation is absolute, or with a reservation for the use of the privilege by the proprietor; whether it is with the power of again transferring it or not; and whether the possessor has already transferred it to one or more persons.

19th.—The person making the transfer, shall be obliged to present evidence of the deeds of transfer, to the *Intendant* before whom the representation for obtaining the privilege was made; and he, after having taken cognizance of the transfer, shall transmit that evidence to the *Council of State*, who shall give corresponding notice to the *Royal Conservatory of Arts*, in order

order to have it noted in the register, whereof mention is made in Article 14. The transfer shall be null if the evidence of the deed of transfer is not presented to the Intendant within thirty days after its execution.

20th.—The duration of the privilege shall reckon from the date of the *royal patent*.

21st.—The effect of that royal patent shall cease, and the privilege shall become null, and of no force; 1st, when the time named in the grant shall have elapsed; 2d, when the party interested shall not present himself to receive the royal patent within three months of the day when he presented his petition; 3d, when he shall not have put the invention for which the privilege is granted, into practice, either for himself or for another person, within a year and a day after the date of the patent; 4th, when the party interested abandons the invention, whereby is understood, when he ceases to practice the object for a year and a day uninterruptedly; 5th, when it is proved that the invention has previously been in practice in any part of the kingdom, or described in printed books, or in engravings, pictures, models, plans, or descriptions, contained in the *Royal Conservatory of Arts*, or that it shall have been executed or established in other countries, the interested party having presented it as new, and of his own invention.

22d.—When the time of the grant of the privilege has elapsed, the director of the *Royal Conservatory of Arts* shall give notice to the *Council of State*, of the day of expiration, and the Council will declare the cessation.

23d.—In all the other mentioned cases of cessation, a competent judge shall proceed, at the suit of any party, to try the fact, and the cessation being proved, he shall give notice to the *Council of State*, that the cessation of the privilege may be publicly declared.

24th.—The judges who shall take cognizance of these matters, shall be the *Intendants* in their respective provinces; petitions (or pleas) must be made to the Intendant of the province wherein the defendant resides; and appeals shall be made to the *Council of State*.

25th.—When a privilege becomes void, for any of the causes mentioned in Article 21, the box, or the packet of the documents deposited in the *Conservatory of Arts*, shall be opened by the *director* of the same, and the whole shall be open to public inspection, the cessation being also announced in the *Gazette*.

26th.—The possessor of a privilege obtained under any title whatsoever, shall have a right to cite, and pursue to judgment, before the courts, all persons usurping his right; the *Intendants* of the provinces wherein the defendants reside, shall take cognizance of these actions, and appeals shall be referred to the *Council of State*.

27th.—The plea being proved, the offender shall be condemned to the confiscation of all the machines, apparatus, utensils and works of art made in violation of the privilege, and to the payment, as a fine, of three times the value of the same, at an evaluation by competent persons, and the whole to be for the benefit of the possessor of the privilege hereof.

28th.—The privileges already granted before this date, shall remain in force under the conditions of their grants; and those which were granted with a reservation, to be determined by this present royal decree, shall comply with the enactments hereof.

YOU shall hold these presents understood, and you shall give suitable orders for their accomplishment.

This is signed by my royal hand, at the Palace, 27th March 1826.

To Don Louis Lopez Ballesteros.

Models referred to in the Spanish law of the 27th March 1826.

MODEL, N° 1.

To the Señor Intendant of the Province of

residing near [or at] [here name the profession, calling or condition of the party] state to your Lordship with all due respect; that, in order to secure the property of a machine [instrument, apparatus, process or operation, which ver it is] which I have invented [or brought from another country] for [here state the object of the machine, &c.] conformably to what His Majesty has ordained for such cases; I present to your Lordship a suitable memorial for His Majesty, and a packet [or box] closed, sealed and indorsed in the following form [here transcribe the indorsement of the packet or box]: And for the same purpose I supplicate your Lordship to sign the said packet [or box] with presented and to grant to me the corresponding certificate; and to give me the suitable dispatch for his Excellency the Secretary of State, and for his office; that the whole may be delivered into his hands, according to the provisions to that effect, [here put the name of the town, the day, month and year.]

Signature of the party, or of his authorized agent.

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MODEL, N° 2.

Señor

N. residing near [or at] [here put the profession, calling or condition of the party] lays before your Majesty, with the greatest respect, that in order to assure to himself the property of a machine, [instrument, apparatus, process or operation, whichever it may be,] which he has invented [or brought from another country] for [here state the object of the machine, instrument, &c.] in conformity with the ordinances of your Majesty in such matters: Therefore he supplicates your Majesty to be pleased to order for him the issue of a suitable Royal Patent of privilege for [number of years] which he will receive as a royal favour [here insert the town, day, month and year.

Señor

Signature of the party or of his agent.

MODEL, N° 3.

PETITION for the Royal Patent of Privilege, which N. [of such a place] presented to the Intendant of [state what invention, literally, from the memorial to His Majesty] this day the [of such a month, such a year, at such an hour.]

Signature of the party or his agent.

Here the Intendant shall put
"Presented."
and shall sign it.

MODEL, N° 4.

Don Ferdinand VII. by the grace of God, &c. Forasmuch as N. [here the name, surname, profession and residence of the party,] has laid before me in a memorial of [here put the profession, calling or condition of the party] of praying, that in order to assure to him the property of a machine [instrument, apparatus, process or operation] which he has invented [or has brought from another country] for [here the object literally, as the party interested has expressed it in his memorial] conformably to what I have ordained for such matters, that I would be pleased to grant him my Royal Patent of Privilege for the same, and having complied with all the formalities required; Now I grant by this my Patent of Privilege to N. the exclusive property in using, making or selling the said [invention or introduction] dating from this day, [here the date of the presentation to the Intendant] until such day as it shall expire, [according to the term the patent was solicited for]; he having a right to transfer, exchange, sell, or in any other way dispose of, by contract, or by his last will, wholly or in part, the exclusive right given to him by this my Royal Patent, within the limits assigned by me in the law touching this matter. I prohibit every other person except the said N. or those who shall derive rights from him, to use or practise the invention stated in this my Royal Patent, under the established penalties; I order that the same be registered in my Council of State, and in the Royal Conservatory of Arts, taking an account at the same time of the established duties having been paid. Given at on the of of

Appendix (H.)

EXPLANATORY of the mode suggested by Mr. Farey, of recording the definition of the principles of an Invention, at the first application for a Patent, in order to secure the Inventor against any injury from disclosure of the secret, before the date of the Patent; also to allow him a sufficient time to put his ideas to the test of experiment, and to prepare a complete specification of the means of execution before the date of the Patent.

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John Farey, Esq.
8 June 1829.

[Mr. Watt's invention of improvements in the Steam Engine, has been selected, as an example of the proposed mode; and the following is the confidential communication he might have made in writing to an Examiner, at the time when he first made application for a Patent, at the close of the year 1768.]

DEFINITIONS of the Principles of an Invention made by *James Watt*, to improve STEAM ENGINES. Sealed up by him the 7th Nov. 1768.

My method of lessening the consumption of Steam, and consequently of fuel, in fire engines, consists of the following principles:

FIRST:—That vessel in which the powers of steam are to be employed to work the engine, which is called the cylinder in common fire engines, and which I call the steam vessel, must, during the whole time that the engine is kept at work, be kept as hot as the steam that enters it; 1st, by inclosing it in a case of wood, or any other materials that transmit heat slowly. 2dly, By surrounding it with steam or other heated bodies; and 3dly, by suffering neither water nor any other substance colder than the steam, to enter or touch it during that time.

SECONDLY:—In engines that are to be worked wholly or partially by condensation of steam, the steam is to be condensed in vessels distinct from the steam vessels or cylinders, although occasionally communicating with them; these vessels I call condensers; and whilst the engines are working, these condensers ought at least to be kept as cold as the air in the neighbourhood of the engines, by application of water, or other cold bodies.

THIRDLY:—Whatever air or other elastic vapour is not condensed by the cold of the condenser, and may impede the working of the engine, is to be drawn out of the steam vessels or condensers by means of pumps wrought by the engines themselves, or otherwise.

FOURTHLY:—I intend in many cases, to employ the expansive force of steam to press on the pistons, or whatever may be used instead of them, in the same manner as the pressure of the atmosphere is now employed in common fire engines: in cases where cold water cannot be had in plenty, the engines may be wrought by the force of steam only, by discharging the steam into the open air after it has done its office. Note: This should not be understood to extend to any engine where the water to be raised enters the steam vessel itself, or any vessel having an open communication with it.

FIFTHLY:—Where motions round an axis are required, I make the steam vessels in form of hollow rings, or circular channels, with proper inlets and outlets for the steam, mounted on horizontal axes, like the wheels of water mills; within them are placed a number of valves, that suffer any body to go round the channel in one direction only; in these steam vessels are placed weights, so fitted to them, as entirely a part or portion of their channels, yet rendered capable of moving freely in them, by the means hereinafter mentioned or specified. When the steam is admitted in these engines, between these weights and the valves, it acts equally on both, so as to raise the weight to one side of the wheel, and by the re-action on the valves successively, to give a circular motion to the wheel, the valves opening in the direction in which the weights are pressed, but not in the contrary one. As the steam vessel moves round, it is supplied with steam from the boiler; and that which has performed its office may either be discharged by means of condensers, or into the open air.

SIXTHLY:—I intend, in some cases, to apply a degree of cold not capable of reducing the steam to water, but of contracting it considerably, so that the engines may be worked by the alternate expansion and contraction of the steam.

SEVENTHLY:—Instead of using water to render the piston or other parts of the engines, air and steam tight, I employ oils, wax, resinous bodies, fat of animals, quicksilver, and other metals, in their fluid state.

James Watt.

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INDORSEMENT to be written on the outside of the foregoing Paper,
after it is sealed up.

MEMORANDUM:—On the 5th day of November 1768, James Watt, of Glasgow, Engineer, communicated to me (the Examiner appointed for that purpose) the within written definitions of the principles of an invention which he declares to have been made by him to improve Steam Engines, commonly called Fire Engines, so as to lessen the consumption of fuel thereby.

I hereby certify, that I believe the said Invention is not known or in use in Great Britain; that the within written definitions consist of seven distinct articles, which are in my judgment, clearly and intelligibly expressed; and the same have been approved and signed by the said James Watt, who has also paid the sum of thirty pounds for this certificate of his declaration of his having made the Invention herein defined, and hereby recorded this 7th day of November 1768.

Signed by the Examiner.

DEFINITIONS of the Principles of an Invention made by *James Watt*, to improve
STEAM ENGINES. Sealed up by him the 7th Nov. 1768.

Appendix (I.)

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PROPOSED FORM of a **CERTIFICATE** to be given by the Examiner to the Inventor, in acknowledgement of the deposit of the paper containing the definitions of the principles of his invention, being a copy of the indorsement on the outside of that paper; to be written on a printed sheet, containing the principal proposed points that the inventor should attend to in proceeding to obtain a Patent.

(Copy.)

MEMORANDUM:—On the 5th of November 1768, James Watt of Glasgow, Engineer, communicated to me (the Examiner appointed for that purpose) the within written definitions of the principles of an invention which he declared to have been made by him to improve Steam Engines, commonly called Fire Engines, so as to lessen the consumption of fuel thereby.

I hereby certify, that I believe the said invention is not known or in use in Great Britain; that the within written definitions consist of seven distinct articles, which are in my judgment clearly and intelligibly expressed; and the same have been approved and signed by the said James Watt, who has also paid the sum of thirty pounds for this certificate of his declaration of his having made the invention herein defined, and hereby recorded this 7th day of November 1768.

Signed by the Examiner.

Notice to Inventors who have deposited definitions of the principles of an Invention with the Examiner, in order to secure their claim to a Patent for the Invention.

Public notice will be given by advertisement of the deposit, with an invitation to any persons who may desire to offer proof that the invention was not really made by the person depositing the same, or that the invention was publicly known or in use in Great Britain before the date of the deposit. In case of such proof being tendered to the examiner, if he requires to re-examine the definitions, previous notice will be given to the depositor, that if he wishes, he or his agent may be present so long as the said paper of definitions remains open, and may seal the same again.

And if by proof so tendered, or if by other means, the examiner becomes convinced that the invention, or part thereof was publicly known or in use in Great Britain before the date of the deposit, notice of that fact, with the particulars, shall be given to the depositor, and that he cannot have a patent, or that the same cannot extend to such parts of his definitions as are found not to be new.

Or if the invention or part thereof is proved to have been actually used in secret in Great Britain before the date of the deposit, and it appears that the invention originated with two parties independently one of the other, each inventor shall be entitled to a patent by virtue of the deposit already made, for so much of the invention therein defined as each one can prove to have been practised completely by him at the earliest date, each party fulfilling the conditions of the patent granted to him, and paying the expenses thereof, but neither patent shall contain any thing included in the other patent. And if a person thus becoming entitled to a patent for the whole, or part of the invention, declines having the same, the other party may have the patent on condition that a clause shall be inserted, allowing the person so entitled, but declining to have the patent, to practise the invention in his own trade or business. Also in case where the proof of first practice, or the completeness of that practice, is doubtful to the examiner, or if the invention, as defined in the deposit, cannot be clearly divided between the parties in distinct patents, which cannot interfere one with the other, the patent shall be granted to both parties jointly at their joint expense, and jointly or separately fulfilling the conditions, if they agree thereto; or if either party declines having the patent, then to the other party, at his own expense and by his own fulfilling of the conditions, with a clause permitting the party so declining to practise the invention.

Note.—In all cases when any decision is made by the Examiner, or Board of Examiners, any interested party who is dissatisfied with that decision, may demand an arbitration, he appointing one arbitrator, and calling upon his opponent to appoint the other; or if there is no opponent, then the examiner to appoint that other arbitrator. The two arbitrators shall appoint their umpire; the award to be final, without further appeal.

Note.—All proof against a patent being granted, must be tendered to the examiner within ten days of the expiration of the three calendar months from the date of the deposit, and proof so tendered must be made good within five days before that expiration, or else the same cannot be received.

If nothing arises to convince the examiner that the invention is not new, or not really invented by the depositor, the depositor (or other person deriving title from him) may, if he chooses, apply for a patent, by tendering to the examiner at any time within two calendar months after the date of his deposit, a fair draft of what he proposes for his specification, to be inscribed in the Patent for which he applies; he must in that specification describe the best means he shall then have devised of carrying his invention into practice, with

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John Farey, Esq.
8 June 1829.

drawings, if necessary to the explanation. The examiner will decide if such draft is intelligibly expressed, and will summons the applicant to appear by himself or his agent, to explain and amend the same if required, until the description shall be, to the satisfaction of the examiner, sufficiently explicit to enable competent persons to practise the said invention, and also, that the invention is really the same, or part of the same, that was originally defined in the deposit. The said draft must be settled as examined and approved by the examiner, and must be fairly engrossed, and the engrossed deed must be examined, and executed by the applicant, and inrolled as his specification within three calendar months of the date of the deposit; and as soon afterwards as may be conveniently done, a patent will be delivered, bearing date, and taking effect, at such three calendar months after the date of the deposit, the specification as inrolled being transcribed into that patent.

The patent thus issued will be for the exclusive use and benefit, of all or so much of the invention defined in the deposit, as has been rendered complete by the specification duly examined, approved, executed and inrolled as before directed.

The inventor may sell and assign the invention of which he has deposited the definition, or any part thereof, and his assignee (or assignees not exceeding five in number) may have the patent, he or they fulfilling the conditions; or, in case of the death of the inventor, his legal representatives may so sell or assign the invention, or may have the patent the same as he himself might have had.

The patent so to be granted, may at the choice of the applicant, as expressed at the time of inrolling the specification, be for a term of five years, in which case a further sum of twenty pounds shall then be paid for the same; or for a term of ten years, in which case a further sum of seventy pounds shall be paid; or for a term of fifteen years, in which case a further sum of one hundred and twenty pounds shall be paid for the patent.

The said patent will extend to all parts of the British dominions, and will begin to be in force from the time of its date. In case any persons have begun to practise the invention before the date of the patent, but after the date of the certificate of invention, such previous practice not to be accounted any infringement.

And all machinery or apparatus actually made complete by others besides the patentee, and fit for use for the practice of the invention, before the date of the patent for the same, may continue to be used, on paying such compensation to the patentee for the use thereof, after the date of the patent, as shall be awarded to him by arbitration.

In case the inventor or his assignee or representatives, do not desire to pursue the patent, or cannot fulfil the conditions, he or they may withdraw the definitions of the principles of the invention, without the same having been communicated further than to the examiner. The money paid is then forfeited. The same invention, or any part thereof, may be recorded and certified again by the same or other parties, at any time within six months after being so withdrawn, provided it has not become publicly known or used in Great Britain before such second recording.

In case the inventor shall not have brought the invention to such a state as to be prepared, within two calendar months after the date of the deposit, to specify proper means of executing the same, he may apply to the examiner, and state what he has done, and what more he proposes to do; and the examiner has power to allow more time, not exceeding three months, for the inrolling of the specification and dating of the patent, provided he is satisfied that there is good cause for allowing more time. And in case, at the expiration of such extended time, the inventor shall still be unable to specify, he may appoint an assessor or arbitrator, and the examiner will appoint another, and they two shall appoint an umpire, and shall then examine the progress made in bringing the invention to bear, and what more is proposed to be done; and such arbitrators, or their umpire, shall have power to award more time, not exceeding twelve months, provided they are satisfied that there is good cause.

Note.—In either of the above cases when more time is allowed, the inventor must confine his future claim for a patent, to such articles in his definitions of the principles of the invention, as he can shew that he has really worked upon, to bring them to bear; and those articles, with such amendments and explanation thereof, as the inventor may be able to make to the satisfaction of the examiner, or of the arbitrators or their umpire, must remain open for public inspection, during the extended time.

Appendix (K.)

Appendix (K.)

PROPOSED FORM of ADVERTISEMENT, which, in Mr. Watt's Case, should have been inserted in the London Gazette, and in some Newspapers of greatest circulation in Edinburgh, Glasgow, Dublin, Newcastle, and in Cornwall, being the places where Steam or Fire Engines were most common.

WHEREAS James Watt, of Glasgow, Engineer, has declared that he has invented certain improvements in Steam Engines, commonly called Fire Engines, so as to lessen the consumption of fuel thereby; and has deposited a written definition of the principles of the said invention with the examiner appointed for that purpose, on the 7th of November 1768: This is to give Notice, That the said James Watt, or such persons as may derive a legal title from him, will become entitled to have a Patent for the said invention, bearing date the 7th day of February 1769, on his or their fulfilling the usual conditions; unless it is proved within five days before that date, either that he is not the first and true inventor of the said invention, or that the same was publicly known or in use in Great Britain before the 7th of November 1768; persons desiring to offer proof to that effect, may apply to me at any time before the 26th of January 1769.

Signed by the Examiner.

Appendix (L.)

Appendix (B.)

Papers
delivered in by
John Farey, Esq.
8 June 1829.

PROPOSED FORM of a CERTIFICATE, or AWARD, for allowing an Inventor further time to bring his Invention to bear, beyond the Three Months allowed after depositing the Definition of his Principle.

[I, A. B. being the examiner appointed, &c. or, if it is an award for a second extension of time, we, the undersigned, C. D. being the assessor chosen by James Watt, engineer, &c. and E. F. being the assessor chosen by the examiner A. B.] do hereby certify, that I [or, we] have examined the progress made by the said James Watt, towards perfecting his invention of improvements in steam engines, whereof the principles were defined in a paper deposited by him with the examiner, under seal, the 7th November 1768; and considering all the circumstances, I am [or, we are] of opinion, that there is a reasonable probability that the said James Watt, by continuing the course of experiments in which he is now engaged, will ultimately succeed in bringing to bear the means of executing the following improvements in steam engines, in order to lessen the consumption of steam, and consequently of fuel, and also to improve the powers of such engines.

1st.—To enclose or surround the working cylinder of the engine within a case, containing steam from the boiler, in order to keep the cylinder as hot as the steam that enters it, during the whole time that the engine is at work, suffering neither water, nor any substance colder than the steam, to touch the cylinder during that time. Also to surround the said case, which encloses the working cylinder, and contains steam, with an exterior casing of wood, or of any other materials that transmit heat slowly.

2d.—To condense the steam in a condensing vessel, which is distinct from the working cylinder, and is kept so cold by surrounding it with cold water, as to cool and condense all the steam that is admitted into such condenser, in order to maintain a partial vacuum or exhaustion therein. The said cold exhausted condenser is made to communicate occasionally with the cylinder, in order to draw off, and exhaust the steam therefrom, so as to form a partial vacuum in the cylinder beneath the piston.

3d.—To draw out from the said condenser, by means of pumps worked by the engine, any air or other elastic vapour, that is not condensed by the cold of the condenser; and also the hot distilled water proceeding from the condensation of the steam, in order to prevent the condenser from choking up, and to constantly maintain the partial vacuum or exhaustion therein.

4th.—To employ the expansive force of the steam from the boiler to press upon and impel the piston (instead of the pressure of the atmosphere, as in common fire engines) in order to give motion to the piston, when the steam beneath the same has been exhausted from the lower part of the cylinder, by opening the communication with the condenser.

Lastly.—To employ oil, or the fat of animals in a fluid state, to render the piston tight, in lieu of water, as commonly used in fire engines.

And by virtue of the powers and discretion vested in me [or, us] according to the Act, &c. I [or, we] being convinced of the propriety of allowing the said James Watt time to complete his said experiments, do hereby certify [or, award] that the time for granting a patent to him for the improvements whereof the principles are herein before defined, may be extended until the 7th of May 1769 [or, if by award, 1770]; that patent being for such part of the said improvements as the said James Watt shall have previously described the means of executing, in a specification, duly examined, executed and recorded.

Signed by the Examiner, or by the Assessors, or their Umpire.

Note.—The exclusive right that will be conferred by the patent when granted will be confined to what is stated in the award, and that must be substantially conformable to the definitions originally deposited; but the expressions may be amended and improved, according to the judgment of the assessors. The above document to be recorded, and to be open to public inspection. An official copy to be given to the inventor, written on a printed sheet, containing such points of law and regulation as are most necessary for him to know. Such articles of the definitions contained in the original sealed packet as are omitted, because they have not been so far executed as to give the examiner or assessors a reasonable prospect of some useful results being attained within the proposed time, are not to be disclosed, and the inventor may deposit them again as a new invention, at any time within six months after the first deposit, because the first communications to the examiner and assessors were confidential, and no publication. The award to be taken as a publication and enunciation of the claims of the inventor, by which he must ultimately abide.

Appendix (M.)

Papers
delivered in by
John Farey, Esq.
8 June 1829.

Appendix (M.)

PROPOSED FORM of a SPECIFICATION of an INVENTION, whereof the Principles have been previously defined and recorded in a sealed Packet, deposited with the Examiner.

SPECIFICATION of the means of executing an invention made by James Watt, of Glasgow, engineer, &c. for improving the performance of fire engines or steam engines, and lessening the consumption of steam, and consequently of fuel thereby; the principles of which invention were communicated by the said James Watt to A. B., the examiner appointed, &c. and were recorded in a sealed paper on the 7th of November 1768; and in consequence of the difficulties of executing the improvements, the said James Watt was allowed a further time than usual for making experiments; first, by a certificate of the examiner, dated the day of 1769; and also by an award of C. D. and E. F., assessors appointed, &c. dated the day of 1769; and in which award the principles of the said invention were stated to be as follows:

[Here follow the articles from the award, which constitute the claims of the inventor.]

See Appendix (L.)

The said James Watt hereby declares, that the following is, to the best of his judgment and knowledge, the most complete and beneficial mode that he has yet found out for executing the said improvements:

See the Engraving.

The annexed drawing is a section of a fire engine, which was formerly an atmospheric engine, of the common or Newcomen's construction, but which I have altered and made to work with a very diminished consumption of fuel, by my new improvements, in the following manner: The parts which are so altered as to their place, size, arrangement, or construction, as to require to be made anew, are, the boiler C, the cylinder E, and the working gear *r s t u*. The parts which are entirely new additions to the parts of the old engine, are, the condensing cistern G, and the air pump H, and condenser F within the condensing cistern; also the eduction pipe *g*, and the valves *e* and *i*; likewise the hot-water pump S, for feeding the boiler. The engine-house, the great lever beam, and the pump-work in the pit of the mine, remain as they were; the boiler which stood under the cylinder is removed, and a new boiler of smaller dimensions is placed in any convenient situation at one side of the cylinder. In the drawing, the boiler C is represented as being under the arch through the end wall of the engine-house. The beams which are commonly fixed across the house, to suspend the cylinder of an atmospheric engine between them, are removed; also the ascending pipe from the jack-head pump R, together with the injection cistern at the top of the house, and its descending pipe, for conveying the injection water to the lower part of the cylinder; the working gear suitable for an atmospheric engine is also removed.

The vacancy left by the removal of the boiler from beneath the cylinder, is filled up by building a strong wall X across the house, that wall being founded upon strong beams which are laid across the engine-house, the ends being fixed into the side walls. The masonry is carried up to a proper height, to form a basement or pier X, for my new cylinder; which is supported on its bottom, instead of being suspended by the middle; and it is fastened down to the cylinder pier X, by four long bolts, which pass down through holes left in the masonry, the bolts being held by cross keys put through them, beneath the cross beams, at the foundation of the cylinder pier X.

My new cylinder E E is made smaller than the former cylinder, being of such a size that the weight of the columns of water which are to be raised by the engine will be at the rate of between 10 and 11 pounds avoirdupois for every square inch of the area of the piston. The cylinder E E is enclosed within another cylinder *d d*, which I call the steam case, which is so much larger than the working cylinder, as to leave a small space all round the same for the admission of steam. The working cylinder E E is open at top, and is bored smooth and true within side, in the same manner as the common fire-engine cylinders, but it requires to be bored much more correctly cylindrical than usual. The piston J is accurately fitted into the bored cylinder, and is packed round the circumference with hemp. The steam case *d d* is closed at top by a circular cover, fastened by screw bolts to the flange at the top of the steam case. Through the centre of the cover the piston rod *n* passes, in a hole to which it is correctly fitted, being made straight and cylindrical, and fixed exactly in the centre of the piston: on the top of the cover, at its centre, a short cylindrical box *x* is fastened by screws, to contain a stuffing or packing of hemp, which is rammed tight into the box *x*, to fill up the space around the piston rod, and the rod is thereby fitted so closely on all sides as to prevent the passage of any steam out of the steam case into the open air. To retain the hemp stuffing in the box *x*, a small perforated cover is applied over that box, and fastened by screws to a flange at the top thereof: the piston rod passes through the centre of the small cover, which has a projecting rim at the under side of it, around the perforation, to fit into the box *x*, over the hemp stuffing, so as to press down thereon with all the force of the screws by which the small cover is fastened to the flange of the box *x*. The piston rod must be well polished, so as to move freely up and down, through the stuffing in the box *x*, at the centre of the great cover, without allowing any steam to escape. Hence it is obvious that the piston rod, piston, and the interior of the cylinder, must be formed with extreme accuracy, straight and cylindrical, and truly concentric one with the other, and made very smooth on the surfaces.

The

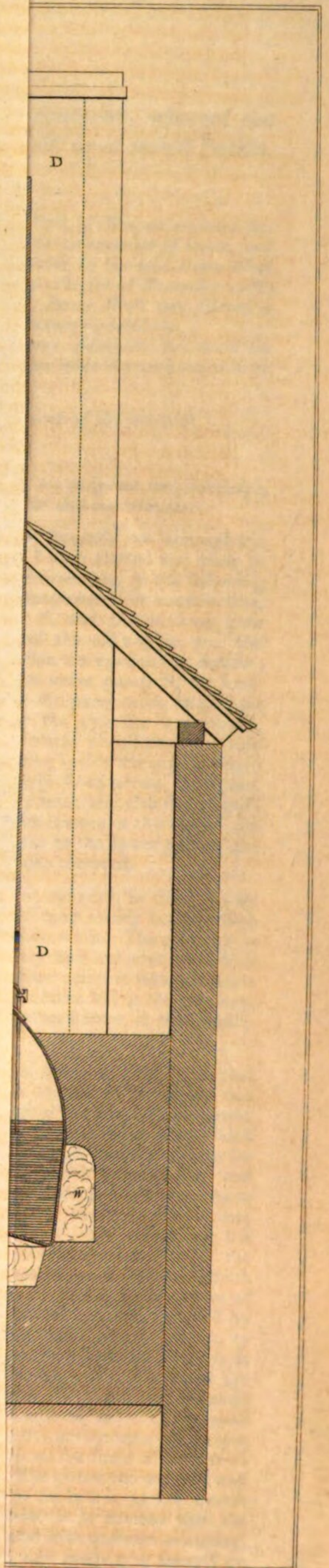
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The steam from the boiler C, is conveyed by a steam pipe *a*, into the space between the steam case *d d*, and the cylinder E E; the upper edge of the cylinder E E does not reach quite up to the cover, leaving an open space all-round to admit the steam to flow into the top of the cylinder, and press constantly on the piston. The working cylinder E E may therefore be considered as included within an atmosphere of steam, in the same manner as the cylinder of Newcomen's engine is surrounded by the atmospheric air, but the steam preserves every part of the working cylinder at the same uniform temperature as the steam itself, and thereby all condensation of steam within the cylinder is avoided. The outside of the steam case *d d*, is surrounded with wood staves, like those of a cask, and held by hoops, or it may be wrapped round with hay-bands, or surrounded with brickwork and plaistered, to cloathe it, and prevent needless loss of heat to the surrounding air.

From the lower part of the cylinder E E a passage *ff* extends out horizontally to contain the two circular lifting valves *e* and *i*, which are provided for the purpose of alternately conveying steam from the boiler into the lower part of the cylinder, or exhausting that steam therefrom by the condenser F. The steam can be admitted from a box which projects out from the lower part of the steam case *d d*, over the passage *f*, by the circular valve *e*, called the equilibrium valve, which valve being lifted up allows the steam from the steam case to enter freely through *f* into the cylinder beneath the piston J, and then the steam will press as much beneath the piston as above, whereby it will be placed in equilibrium, and the action of the counterweight or preponderance of the pump rod suspended at the outer end of the great lever beam, will draw up the piston J to the top of the cylinder in the usual manner of fire engines, into the position that is represented in the drawing. When the steam is to be exhausted from the cylinder beneath the piston J, the equilibrium valve *e* must be shut down, and the other circular valve *i*, called the exhausting valve, must be lifted up to open a communication between the passage *f*, at the bottom of the cylinder, and the eduction pipe *gg*, which leads to the condenser F, where the steam is to be cooled and condensed in order to obtain a vacuum.

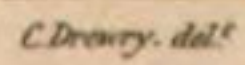
My new condenser F is a close vessel, made of thin copper plate, in such a form as to expose a very extensive surface, externally and internally; it is immersed in cold water, contained in a cistern G, and as the heat can pass readily through the thin metal, of which the condenser is composed, the cold water will absorb the heat from the steam as fast as it enters into the condenser. The form of my condenser may be varied; it may be either a large flat vessel, resembling a book placed edgeways upwards, and which may be supposed to be seen edgeways in the section at F, or else the condenser may be composed of several cylindrical tubes of thin copper placed side by side in a row, in a vertical position, being all joined together by one horizontal square tube at top, and another such horizontal tube at bottom. F represents one of those vertical tubes, the others (being supposed to be behind it, or else to be removed by the section) cannot be seen, but the horizontal square tubes which join the tops and bottoms of all the vertical tubes F are seen in section at *o* and *p*. There are six of the tubes F side by side in a row, which, together with the square tubes at top and bottom, form one capacious vessel or condenser made of thin metal, with a great extent of external surface, and immersed in cold water.

The condensation of the steam within the condenser, by the cold of the external water, occasions the water of which the steam is composed to be precipitated against the internal surface of the condenser in dew, which trickles down in drops of hot water, and collects together in the square tube which forms the bottom of the condenser. This hot water is extracted from the condenser by a pump H, called the air pump, because it is also required to extract any air which may gain admission into the condenser by leakage, or with the steam. The construction of my air pump H is nearly the same as any common sucking pump, with a valve or clack at the bottom of the barrel, and other valves in the moveable bucket, which is suspended by a rod and chain from an arch fixed to the great lever beam, as shown in the drawing. The bottom or clack piece of the pump turns sideways, and joins to the square tube at the bottom of the condenser, near the middle of its length. The valve at the bottom of the air pump H, and also the valves in the bucket of the pump opening upwards, will allow water and air to be drawn out of the condenser F, but will not allow any to return; those valves may be made the same as the valves in the bucket and clack of a common lifting pump, but with metal hinges, instead of leather.

The operation of my air pump H is to extract the water and air from my condenser F, every time that the bucket is drawn up by the working of the engine; and when the bucket descends, the valve at the bottom of the pump prevents any return of that water and air into the condenser. Therefore by the cooling effect of the surrounding cold water contained in the condensing cistern G, aided by the continual working of the air pump H, a perpetual vacuum (or exhaustion approaching to a vacuum) is maintained within the condenser F, and the steam which is admitted into that condenser is immediately cooled and condensed.

The valves *e* and *i* are of the kind called puppet clacks, such as are used for the safety valves to boilers, being flat circular plates of brass, made conical on their edges, and accurately fitted into corresponding apertures in circular brass seats, which are fixed, one in the upper, and the other in the lower part of the passage *f*; the spindles, which are fixed in the centres of the valves, project upwards and downwards, and are received in sockets to retain the valves exactly over the apertures; the upper ends of the spindles rise up through stuffing boxes to the outside of the boxes, in which the valves are enclosed, and the upper ends are connected with levers, by which the valves can be lifted up or pressed down, so as to open or shut the passages, and in so moving they will certainly return or drop exactly into their seats. The stuffing boxes through which the spindles of the valves pass, are formed in the centres of covers, which can be removed to give access to the valves when they require repairs; those covers and stuffing boxes are like the cover and stuffing box *x* of the cylinder, but in miniature, and are in like manner fastened in their places by screw bolts.

*Papers delivered in
by John Farcy Esq.^{re}
8th June, 1829.*



The steam from the boiler C, is conveyed by a steam pipe *a*, into the space between the steam case *d d*, and the cylinder E E; the upper edge of the cylinder E E does not reach quite up to the cover, leaving an open space all-round to admit the steam to flow into the top of the cylinder, and press constantly on the piston. The working cylinder E E may therefore be considered as included within an atmosphere of steam, in the same manner as the cylinder of Newcomen's engine is surrounded by the atmospheric air, but the steam preserves every part of the working cylinder at the same uniform temperature as the steam itself, and thereby all condensation of steam within the cylinder is avoided. The outside of the steam case *d d*, is surrounded with wood staves, like those of a cask, and held by hoops, or it may be wrapped round with hay-bands, or surrounded with brickwork and plaistered, to cloathe it, and prevent needless loss of heat to the surrounding air.

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Appendix (M.)

Papers
delivered in by
John Farey, Esq.
8 June 1829.

The two circular valves *e* and *i*, are alternately lifted up from, and let fall into their seats by the working gear, which operates in a similar manner to that of other fire-engines. The plug beam *l*, which is suspended from the great lever by a chain, has two pins fixed in it on each side, to give motion to two handles or short levers *r* and *s*, which project out from two horizontal axes *t* and *u*, which are supported near the top of the cylinder, between two upright posts, at a convenient height from the floor, for the engine-keeper to take hold of those handles in order to work the engine by hand when requisite, to start, or stop, or govern its motion. On the axes *t* and *u* of the working gear, two short levers are also fixed, and they are connected by upright rods 4 and 6, with the two levers which are connected with the upper ends of the upright spindles of the two circular lifting valves *e* and *i*, where those spindles come up through the stuffing boxes, in order to lift up those valves and open the passages for the steam, or to put down the valves so as to close those passages. The two short levers of the rods 4 and 6, are so fixed upon the horizontal axes *t* and *u*, in respect to the handles *r* and *s*, that the working gear will open one valve *e*, and shut the other valve *i*, simultaneously, every time that the pins on the plug rod *l* meet the handles *r* and *s*, to raise them up or to press them down. Weights are suspended by two rods 16, from joints at the upper ends of two short levers, which are fixed upon the horizontal axes *t* and *u* of the working gear, in such position in respect to the other levers and handles thereon, that those levers to which the weights are suspended by the rods 16 will incline from the perpendicular when the axes are turned one way, in order to lift up and open their respective valves, and that the said levers will incline on the opposite side of the perpendicular when the axes are turned the other way, in order to put down and shut the valves, whereby the two weights and rods 16, produce the same effect as the tumbling bob or hammer of the common working gear of an atmospheric engine; that is to give the handles *r* and *s* a tendency to move suddenly by themselves, after they have been moved about half way by the pins of the plug rod *l*, or by hand; and also they give the handles a tendency to remain whichever way they are placed, whether up or down, and thereby to keep their respective valves either quite shut or quite open. The weights suspended by the rods 16, are heavy pieces of wood, with one end resting on the floor, and the other end suspended by the rods, like the treadles of a loom, and iron weights are placed upon them at a greater or lesser distance from the fixed ends, in order to give more or less force of action to open and shut the valves; also check straps are applied to the said treadles, to limit their fall, and by regulating the lengths of those check straps, the valves can be lifted to a greater or lesser height, as may be found necessary.

The piston *J*, of my engine, is packed round the edge with hemp, formed into soft ropes or strands, of which three or four are platted together into a flat band or gasket. The projecting rim round the lower edge of the piston is exactly fitted into the cylinder, and forms the bottom of a groove round the piston; the gasket is rammed very tight into the space round the edge of the piston above that lower rim, and then a ring is applied over the hemp, its outer circumference fitting the cylinder, and its inner circumference fitting the piston; this ring is pressed down upon the hemp packing with screws to confine it, and the ring forms the upper side of the groove in which the packing is lodged. A small funnel and stop-cock is fixed in the cover of the cylinder, to hold oil or melted grease or fat, which can be let down into the cylinder when necessary, by opening the cock, in order to lubricate the packing of the piston, and also to prevent the escape of steam by it.

The operation of the Engine with my improvements is as follows: Suppose the steam to be raised in the boiler *C* in the usual manner, until it escapes at the safety valve *V*, it will pass through the steam pipe *a* into the steam case *dd*, within the space between the steam case and the cylinder *EE*, whence it will pass into the upper part of the cylinder *E*, above the piston *J*. The lower part of the cylinder *E*, beneath the piston *J*, the eduction pipe *g*, and the condenser *F*, must first be cleared of the common air, which is done by lifting up the handle *r*, and pressing down the handle *s*, so as to open both the valves *e* and *i* at once, whereby the steam is allowed to pass from the boiler *C*, and the steam case *dd*, through the valve *e*, then across the passage *f*, and through the other valve *i*, and the eduction pipe *g*, into the condenser *F*; before this is attempted, the steam must be sufficiently accumulated in the boiler *C*, to cause it to rush with rapidity through these passages into the condenser, in order to expel the contained air therefrom through a small snifting clack, which is provided at the lower part of the condenser, to allow the air to escape into the open air; this snifting action must be continued till the steam has expelled a great part of the air: the equilibrium valve *e*, must be shut from time to time during the clearing of air, by lifting up the handle *s*, to prevent the great and direct passage of steam from the boiler through the steam case to the condenser, and then the external cold water which is continually absorbing the heat from the steam, will very quickly condense all the steam left in the condenser, so as to form an exhaustion therein, whereupon some of the air in the lower part of the cylinder will pass away to the exhausted condenser, and then when the handle *s* is pressed down to open the equilibrium valve *e* again, the steam from the steam case will pass into the cylinder *E*, below the piston in place of the air which was there before, and the snifting or blowing of the air out of the condenser will take place again.

That snifting or blowing must be repeated again and again, steam being accumulated in the boiler in the intervals, until nearly all the air, or as much as can be, is expelled, and then, on closing the equilibrium valve *e* to stop the steam, the vacuum that is formed immediately afterwards in the condenser will draw off the steam that is contained in the lower part of the cylinder beneath the piston, through the passage *f*, and eduction pipe *g*, into the exhausted space within the condenser; but by coming in contact with the cold interior surface of that vessel, the steam is deprived of its heat, and is reduced into drops of warm water, which trickle down to the bottom of the condenser; therefore the condenser is not at all filled up by as much steam as so flows into it, from the cylinder, because by the condensation of the steam as fast as it enters, the original exhaustion is maintained, and consequently the steam in the lower part of the cylinder continues to flow out into the condenser,

till

till none, or very little, is left, and the same exhaustion is effected beneath the piston as there is in the condenser. The steam from the boiler having free access at all times to the upper part of the cylinder, so as to press continually down upon the piston, is no longer counteracted by the upward pressure of any steam underneath it, when the cylinder is exhausted; therefore the piston is pressed down into the exhausted cylinder by the steam acting above it; the great lever at the same time raises the column of water in the pumps in the mine, and also draws up the buckets of the air pump H, cold-water pump R, and hot-water pump S.

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When the piston reaches the bottom of its course, a pin in the plug rod *l* presses down the handle *r*, and shuts the exhausting valve *i*; whilst another pin on the opposite side presses down the handle *s*, and opens the equilibrium valve *e*: the steam from the steam case is thereby admitted into the cylinder, beneath the piston, so as to counteract the steam which continues to be admitted above the piston; consequently an equilibrium of pressure is produced, and the piston being set at liberty, is drawn up by the counterweight, till it arrives at the top of the cylinder, which becomes filled with steam beneath the piston, as fast as the piston rises; the two lower pins in the plug rod *l* then lift up both the handles *r* and *s*, to shut the equilibrium valve *e*, and open the exhaustion valve *i*, whereupon the steam beneath the piston is again drawn off to the condenser, to exhaust the cylinder, in order to make another stroke as before.

Every time that the bucket of the air pump H is drawn up in its barrel, it brings with it all the water and air which have risen up through its valves, during the previous descent of the bucket, and that water and air are delivered into a cistern or hot well I, at the top of the air-pump barrel. After the engine has made a few strokes, the air pump will have drawn out from the condenser all the remaining air, which was not cleared by the snifting, and after that the engine will work readily, the cylinder being exhausted almost instantaneously when the exhausting valve *i* is opened. The small hot-water pump S, draws its water by a suction pipe, out of the hot well I, at the top of the air pump, and raises the hot water high enough to run through the pipe 8, and cock 8, to supply water to the boiler through the upright feeding pipe T; the quantity being regulated by the cock 8, according to the indications of the guage cocks *y*, in the usual manner.

The water in the condensing cistern G is kept cool by a constant supply of cold water, that is drawn by the cold-water pump R, which is the same as in other engines; its spout delivers into the cistern G, and the water, which has become warmed, runs off waste from the cistern G; and thus the water therein is enabled to condense the steam within the condenser, as fast as it is exhausted or drawn off from the cylinder.

The boiler C, with its furnace A, fire grate B, flues *w*, and chimney D, are on the same construction as in other engines; the boiler is also furnished with a safety valve V, a man-hole to clean it out, and guage pipes *y*, to show the height of the water within it in the usual manner.

The dimensions of the different parts may be found by the scale to the drawing.

And the said James Watt hereby further declares, that although the above is to the best of his judgment a complete description of the most beneficial means he has hitherto been able to find out for executing his said improvements, whereof the principles have been fixed by the award as aforesaid, he nevertheless engages, that he will at any time, when called upon by any examiner appointed, &c. give all such further explanation of the said means of executing his improvements as may be required, to the best of his knowledge at the time; and will also communicate all such other better means of executing the said improvements, as he may hereafter find out and put in practice during the continuance of the patent granted to him for his invention, either by way of application for a further patent for improvements, if he shall desire such patent, or else by way of supplement to this specification, if the said examiner shall deem the same to be necessary.

(signed) James Watt.

This is to certify, that I have carefully examined the above specification, and to the best of my judgment it is a sufficiently intelligible description of the invention.

(signed by the examiner) A. B.

Note.—Messrs. Boulton and Watt erected several engines on the plan above described, and they performed very well; but the condensation of the steam was afterwards found to be greatly accelerated by injecting a small jet of cold water into the eduction pipe or into the condenser, to cool the steam therein, in aid of the external cold; and ultimately it has been found best to depend chiefly upon an injection into the condenser, and mixing with the steam, in preference to depending upon mere external cold for condensation. Mr. Watt stated this improvement in the following manner, in a letter to his friend Mr. Smeaton, dated 24 April 1776.

“ I have made considerable alterations in our engine lately, particularly in the con-
 “ denser; the effect of that which I used at first was liable to be impaired by incrustations
 “ from bad water; therefore we have substituted one which works by an injection. In pur-
 “ suing this idea, I have tried several kinds, and have at last come to one which I am not
 “ inclined to alter. It consists of a jack-head pump, shut at bottom with a common clack;
 “ another clack in the bucket, and a valve in the cover of the pump, to discharge the air
 “ and water. The eduction pipe, which comes from the cylinder, communicates with this
 “ pump, both above and below the bucket, with valves to prevent any thing going
 “ back from the pump to the eduction pipe. The bucket descends by its own weight, and
 “ is raised by the engine, when the great piston descends, being hung to the outer end of
 “ the great lever. The injection is made both into the upper part of this pump, and into
 “ the eduction pipe, and operates beyond my ideas, in point of quickness and perfection.
 “ The air pump of our own engine at Soho is 7 inches diameter, and 20 inches stroke; the

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" working cylinder being 18 inches diameter and 5 feet stroke; the vacuum is such, that
" the mercury in the barometer connected with the condenser, is generally only about
" $1\frac{1}{2}$ inches below that in the weather-glass. One hundred weight of 120 lbs. of Wednes-
" bury coals, raises between 20,000 and 30,000 cubic feet of water 20 feet high."

If the proposed regulations had been then in force, the above communication, in detail, with explanatory drawings, would have formed a proper subject for a supplement to the specification.

The fourth and fifth articles of Mr. Watt's definition of principles [see Appendix H] were not pursued by him for some years; but in the specification of a subsequent patent which he took out in 1782, he describes two kinds of engines to produce motions round an axis, according to the fifth article, with drawings in detail. And again in the specification of another patent in 1784, he describes a portable engine for moving wheel carriages, which has been brought into use by others, and is the best application which has yet been made of the high-pressure principle, laid down in his fourth article. According to the proposed regulation, those articles would not have been made public, so as to have impaired his claim to novelty of principle, as well as of construction under those two subsequent patents.

R E P O R T

FROM THE

SELECT COMMITTEE

ON

STEAM BOATS,

&c.

WITH

THE MINUTES OF EVIDENCE

TAKEN BEFORE THE COMMITTEE.

Ordered, by The House of Commons, to be Printed,

24 June 1817.

THE REPORT

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REPORT.

THE SELECT COMMITTEE appointed to consider of the means of preventing the mischief of Explosion from happening on board STEAM BOATS, to the danger or destruction of His Majesty's Subjects on board such Boats; and who were empowered to report their observations and opinion thereupon to The House; together with the MINUTES OF THE EVIDENCE taken before them; and to whom the Petition of *William Lester*, Esquire, was referred;—HAVE, pursuant to the Order of The House, considered the matters to them referred, and agreed to the following REPORT.

YOUR Committee entered on the task assigned them, with a strong feeling of the inexpediency of legislative interference with the management of private concerns or property, farther than the public safety should demand, and more especially with the exertions of that mechanical skill and ingenuity, in which the artists of this country are so pre-eminent, by which the labour of man has been greatly abridged, the manufactures of the country carried to an unrivalled perfection, and its commerce extended over the whole world.

Among these, it is impossible for a moment to overlook the introduction of Steam as a most powerful agent, of almost universal application, and of such utility, that but for its assistance, a very large portion of the workmen employed in an extensive mineral district of this kingdom, would be deprived of their subsistence.

A reference to the Evidence taken before Your Committee, will also show with what advantage this power has lately been applied, in Great Britain, to propel vessels both of burthen and passage, how much more extensively it has been used in America, and of what farther application it is certainly capable, if it may not be said to be even now anticipated in prospect.

Such considerations have rendered Your Committee still more averse than when they entered on the inquiry, to propose to the House the adoption of any legislative measure, by which the science and ingenuity of our artists might even appear to be fettered or discouraged.

But they apprehend that a consideration of what is due to public safety, has on several occasions established the principle, that where that safety may be endangered by ignorance, avarice or inattention, against which individuals are unable, either from the want of knowledge, or of the power to protect themselves, it becomes the duty of Parliament to interpose.

In illustration of this principle, many instances might be given; the enactments respecting party-walls in building, the qualification of physicians, pilots, &c. the regulations respecting stage coaches, &c. seem all to be grounded upon it. And Your Committee are of opinion, that its operation may, with at least equal propriety, be extended to the present case, on account of the disastrous consequences likely to ensue from the explosion of the Boiler of a Steam Engine in a passage vessel, and that the causes by which such accidents have generally been produced, have neither been discoverable by the skill nor controulable by the power of the passengers, even where they have been open to observation.

Your Committee find it to be the universal opinion of all persons conversant in such subjects, that Steam Engines of some construction may be applied with perfect security, even to passage vessels; and they generally

agree, though with some exceptions, that those called High Pressure Engines, may be safely used with the precaution of well constructed boilers, and properly adapted Safety-valves; and further, a great majority of opinions lean to Boilers of wrought iron or metal, in preference to cast iron.

Your Committee therefore, in consequence, have come to the following RESOLUTIONS; which they propose to the consideration of the House:

1. *Resolved*, THAT it appears to this Committee, from the evidence of several experienced Engineers, examined before them, that the explosion in the Steam Packet at *Norwich*, was caused not only by the improper construction and materials of the boiler, but the safety valve connected with it having been overloaded; by which the expansive force of the steam was raised to a degree of pressure, beyond that which the boiler was calculated to sustain.

2. *Resolved*, That it appears to this Committee, That in the instances of similar Explosions, in Steam Packets, Manufactories, and other works where steam engines were employed, these accidents were attributable to one or other of the causes above alluded to.

3. *Resolved*, That it is the opinion of this Committee, That, for the prevention of such accidents in future, the means are simple and easy, and not likely to be attended with any inconveniences to the proprietors of Steam Packets, nor with any such additional expense as can either be injurious to the owners, or tend to prevent the increase of such establishments. The means which Your Committee would recommend are comprised in the following Regulations:

That all Steam Packets carrying Passengers for Hire, should be registered at the Port nearest to the place from or to which they proceed:

That all Boilers belonging to the Engines by which such Vessels shall be worked, should be composed of wrought iron or copper:

That every Boiler on board such Steam Packet should, previous to the packet being used for the conveyance of Passengers, be submitted to the inspection of a skilful Engineer, or other person conversant with the subject, who should ascertain, by trial, the strength of such boiler, and should certify his opinion of its sufficient strength, and of the security with which it might be employed to the extent proposed:

That every such Boiler should be provided with two sufficient Safety-valves, one of which should be inaccessible to the engine man, and the other accessible both to him and to the persons on board the packet:

That the inspector shall examine such Safety-valves, and shall certify what is the pressure at which such Safety-valves shall open, which pressure shall not exceed one-third of that by which the boiler has been proved, nor one-sixth of that which by calculation, it shall be reckoned able to sustain:

That a Penalty should be inflicted on any person placing additional weight on either of the Safety-valves.

4. *Resolved*, That the Chairman be directed to move the House, That leave be given to bring in a Bill for enforcing such Regulations as may be necessary for the better management of Steam Packets, and for the security of His Majesty's subjects, who may be Passengers therein.

24 June 1817.

MINUTES OF EVIDENCE.

Martis, 13^o die Maii, 1817.

CHARLES HARVEY, Esquire, in the Chair.

Mr. *Bryan Donkin* called in; and Examined.

Mr.
Bryan Donkin.

WERE you desired to go down to Norwich, to inquire into the cause of the explosion of the Steam Boat?—I went down as a volunteer.

Did you see the steam boat?—No, we did not; it had been removed; we saw the boiler and part of the engine.

Of whom do you speak?—Mr. Timothy Bramah and Mr. Collinge accompanied me.

They were persons perfectly conversant with engines?—Yes.

You saw the boiler and the engine?—I did.

In your opinion, what was the cause of that explosion?—The immediate cause had been the use of steam of a very high expansive force; the proximate cause was the deficiency in the strength of the end of the boiler.

Of what was that boiler made, and what was its construction?—It was made chiefly of wrought iron, but partly of cast iron.

What part was wrought, and what part was cast?—The boiler was cylindrical; the cylindrical part and one end were wrought iron, and the other end was cast iron; it appeared to me to have been previously of wrought iron, but, for what reason I do not know, the wrought iron end had been cut out, and a cast iron end substituted in its place.

Is it your opinion, that any boiler so constructed was unsafe?—As a high pressure boiler, certainly.

What do you call a high pressure?—I should call from thirty lbs. upwards high pressure; the technical phrase is applied to engines where the motive force is given by the expansive force of the steam.

Define what is the technical distinction between high pressure and low pressure engines?—When water is made to boil in the boiler, and confined so as the steam is not allowed to make its escape, it continues to acquire expansive force as it receives increase of heat; in the high pressure engine, the piston of the steam cylinder is forced down by the expansive force of the steam alone, against the resistance of the atmosphere; when the piston has arrived at the bottom of the cylinder, a valve is opened, and the steam is allowed to escape into the atmosphere, and the operation is reversed; the piston of the cylinder is made to ascend by the same kind of force. In the condensing engine, or the low pressure engines, the steam having been once permitted to fill the cylinder, a communication is then made between the cylinder in which the piston works and the vessel in which the steam is condensed: that is the distinguishing feature of the two engines. I will describe a further difference, which contingently arises out of the use of the two; that is, in the high pressure engines the engineer has it at his option to use what degree of expansive force he pleases, to convert an engine adapted for the power of five horses, or producing the power of five horses, to that of ten horses, or to any other extent which he may think his materials capable of sustaining. In the low pressure or condensing engines, the steam can never be advantageously employed above from two and a half to six lbs. upon a square inch.

Whatever power there is in what you call a high pressure engine, the pressure in that engine may increase the power beyond what it is calculated for, and by means of that may render it dangerous?—Certainly.

Is it your opinion, that a boiler could be made of proper materials, with safety valves, and under proper guard and direction, to make that high pressure perfectly safe?—That would depend upon the quantity of pressure to be used; a safety valve might be carried to three hundred, or to any assignable force. I think that a high pressure engine may be made safe to a certain extent, but where they are left *ad libitum* they never can be perfectly safe.

Do you mean to convey the idea, that it is impossible or difficult to adapt to a high pressure engine one or two safety valves joined with a mercurial gauge, acting at the same point of pressure, so as to make it equally safe with that upon any other construction?—In answer to the first part of the

Mr.
Bryan Donkin.

question, relative to the safety valve, I think I have answered that already; that we can apply a safety valve to any degree of pressure without any difficulty, but that the safety of the engine does not totally depend upon the safety valve.

State upon what other circumstances the safety of the engine depends?—My idea of the difficulty of obtaining a proper degree of strength at all times in the materials of which boilers may be made, arises from the constant deterioration which those boilers must be suffering from the action of the fire, and from the various degrees of expansion and contraction operating on different parts of the boiler.

Is it then your opinion, that in high pressure engines carried to that extent you mention, that danger would always operate?—It would not always operate, but it would be extremely liable to accidents.

In fact, you yourself would not chuse to use a high pressure engine, from the difficulty which exists, either more or less?—That is my opinion.

Have you made any calculation what would be the force required to be used to propel a boat in navigable rivers or canals?—This does not admit of a definitive answer. It depends entirely upon opinion, how far one force would be dangerous and another not; but if steam engines are employed for the purpose of propelling boats, that may be effected with perfect safety by the low pressure or condensing engines, where the pressure need not exceed six pounds to the inch.

Of course that must depend upon the resistance to be made, and the velocity required for the boat?—Then I must make choice of a more or less powerful engine; I think it just to state to the Committee, that there is an advantage to be derived from the use of high pressure engines on board boats, which are necessarily loaded differently at different times; this different loading requires a different power in the steam engine, and the high pressure engine is capable of having this additional power given to it without any difficulty, whereas in the low pressure engines they are confined to the force first assigned to them.

What is the maximum of the low pressure engines?—I scarcely ever saw them beyond six lbs.

In high pressure engines there is a great saving of fuel?—There is in one a peculiar kind of those called high pressure engines; there is a considerable saving of fuel in Woolf's engines; but in the common ones, I believe there is but little saving.

If therefore the engines were to be used where the saving of fuel would be of considerable consequence, high pressure engines of a certain construction would be better adapted for that purpose than low pressure engines?—Where the saving was of much consequence.

If engines were to be used at sea, it would be of considerable consequence, the engine and the fuel being contained in a smaller compass?—Woolf's engine is not in a much smaller compass.

When you talk of the deterioration of the boiler, how long would a boiler, properly constructed and constantly used, be used with safety?—That is extremely uncertain; I have known one boiler worn out in six months, and another used for seven or fourteen years; the strength of cast iron boilers is extremely uncertain; cast iron contracts in various degrees in different places, and therefore is liable to break.

You think that all cast iron boilers are dangerous?—Certainly, when used for steam of high expansive force.

In your former answer, where you spoke of the extreme difficulty of so regulating high pressure engines as to insure their safety, did you mean to speak of those which had cast iron boilers, or of both cast and wrought metal ones?—Chiefly as to the cast iron; it is more practicable to make a boiler of the malleable metals to resist a high pressure, as far as the tenacity of the metals is concerned; but another difficulty occurs, which prevents the application of the malleable metals to boilers for high pressure engines, which is that of rendering the joining of the plates secure.

Do you mean then to say, that wrought iron boilers are not in frequent use to high pressure engines, in point of fact?—I believe they are in much less frequent use than the cast iron boilers; and in Woolf's engine, they are scarcely used at all.

Is not the cast iron boiler much cheaper than the wrought?—I can scarcely tell that; I should think the cast iron would be cheaper, if made of equal strength.

In case of the explosion of a cast or a wrought iron boiler, which is attended with the greatest danger?—Cast iron, unquestionably.

Why?—From the frangible nature of the metal.

What

What do you apprehend to be the common effect, in case of the explosion of a cast iron boiler?—The metal is broken into fragments, and driven off with great violence in various directions.

What is the effect when a wrought iron boiler gives way?—Generally a rent; but I have seen one instance of a wrought iron boiler, where the whole of the upper part was rent from the bottom, driven through the house in which it was placed, and carried to a considerable distance; I believe several yards.

Do you apprehend, that speaking generally, and unless by some extraordinary circumstance, such as the wilful shutting of the steam valve, there would be any reason to apprehend such an effect as you have just now mentioned, to arise from the renting of a wrought iron boiler?—No, I scarcely think it possible.

Supposing the boiler to be made of wrought iron, or copper rivetted, and safety valves properly adjusted, with a mercurial gauge also adapted in its diameter with due regard to the size of the boiler, do you conceive that any reasonable apprehension could arise respecting the safety of a high pressure engine?—I think there might; but with less apprehension as to the extent of the destructive effect to be produced.

You speak of less apprehension as to the destructive effect; have the goodness to explain that?—On account that in the malleable metals a simple rending generally takes place, it would seldom happen that the upper part of the boiler would be torn off; but in the cast iron the fragments would be scattered about, and be more destructive.

Do you not know, that wrought iron boilers have been used to all sorts of steam engines for a considerable time past?—Yes.

Did you ever hear of any other than the single instance that you have mentioned, in which a wrought iron boiler burst in such a manner?—No.

Do you know what was the occasion of the top being blown off in the instance you mentioned?—We cannot tell what was the immediate reason, but I suspected it to arise from the shape of the boiler.

What was that shape?—The bottom was of the usual waggon shape boiler, convex inwards; the concave part of the boiler was over the fire, and those who examined it with myself imagined that the engine keeper had suffered the water to be expended, or the whole of it nearly evaporated, leaving a small portion of it in the lag of the boiler.

The boilers invented by Mr. Simms and Mr. Woolf were all of them cast iron?—I believe they were; I never knew them make any other.

Mr. Woolf's boiler has been in use nearly ten years?—I believe it has.

Did you ever hear of any accident happening to their boiler?—Yes, I have; I heard it stated the other day, by a brother-in-law of mine, Mr. Hall of Dartford, that he had known two or three accidents, but without any fatal or injurious effects.

How many engines of the high pressure character have been blown up?—I have heard of several.

Are there more than four?—A great many more, if there are taken into the account those which have exploded in America as well as here.

Do you consider low pressure boilers as safe from explosion in all instances?—Used with no further pressure than six pounds.

What renders them safe?—Because they never employ steam of high expansive force in them.

What are the means by which they are prevented from using steam of high expansive force in them?—Because it would be against the interest of the persons using them to employ it.

Is there any other guard against the condensing engine receiving such a charge of expansive steam as will burst it, than the care of the engineer or the interest of the owner?—Certainly none; because I have known instances where they have used in the same engine both steam of a high expansive force, and condensed it at the same time.

You have never heard of low pressure boilers blowing up?—No; I have never known of any explosion with injurious consequences; they give way repeatedly; but do no injury.

Is there any thing in low pressure boilers which may be depended upon absolutely, for preventing the steam acquiring an expansive force beyond what is intended?—Well regulated safety valves; mercurial gauges or water gauges will at all times secure it.

Do those means of limiting the expansive force in low pressure boilers continue perfectly efficacious under all circumstances of misconstruction and mismanagement?

Mr.
Bryan Donkin.

mismanagement?—That entirely depends upon the construction; I have known safety valves fail in their action from bad construction.

Can such or similar means be applied to high pressure boilers?—Yes, certainly.

Is not the feeding of low pressure boilers usually done by a column of water; and is not this column the great reason of their safety?—That is one reason, but they ought to have a safety valve besides.

Is it not the principal reason of their safety?—It is the most secure one.

If the feeding column of water be taken away, is not the security left to depend upon the safety valve?—Unquestionably.

Are low pressure boilers employed in boats always or commonly fed by a column of water?—I never saw an instance of it.

If the mechanical means which are used to render the low pressure boilers secure succeed, will not similar means render high pressure boilers secure?—As far as the expansive force is not permitted to arrive beyond certain limits, so far it will afford security.

At what expansive force are low pressure boilers safe according to their usual construction?—I have seen very few boilers constructed for the purpose of a low pressure engine, or a condensing engine that would sustain a pressure of ten pounds, without occasioning considerable leakage, or without forcing the joints.

Are they not very often used with a force to render them unsafe?—I never knew an instance of it.

Is not the explosion of them likely to do mischief?—Not under the pressure they are capable of sustaining.

Not even if they are made of cast iron?—Certainly.

Are they uniformly made of wrought iron?—No; several of them are made of cast iron.

Are not the greater number of them made of cast iron?—No; I apprehend not.

You cannot then state to the Committee how many instances of explosion you know of high pressure boilers?—No, I cannot.

Are they more than in low pressure boilers?—I never heard of an explosion in the low pressure boiler of any consequence whatever, merely a giving way of the plates or the wearing out of the boilers; not such a bursting as can be called an explosion.

May not every instance of explosion of the high pressure boilers with which you are acquainted, be traced to bad construction, or palpable mismanagement?—I have never examined many of them, and therefore what they may be immediately traced to I do not know; but all the explosions I have heard of have been occasioned by the use of steam of high expansive force; the one I visited at Norwich certainly arose from the defective construction of the boiler: it was extremely ill constructed.

Was it not as well from the palpable mismanagement of the engineer?—That I do not know; we were told that it was; I have no doubt there had been very great temerity and rashness.

Was not that high pressure boiler which blew up in London the other day at a sugar-house, entirely owing to the most palpable misconstruction?—I saw the boiler after it had burst; and I certainly should not have made a boiler in that shape, to have withstood the pressure which it was intended to bear.

Was not that boiler made of a different thickness; one side of it three-quarters of an inch thick, and the other side two inches thick?—Those are very nearly the dimensions; but in addition to that, there was a defect in the casting, what we call a cold shut in the iron.

Is not the use of high pressure steam completely in its infancy?—Certainly, its introduction to general use is of much later date than the low pressure steam engines.

It is in fact to be considered as an invention of recent date?—It is.

Have not material improvements taken place in the construction and use of high pressure boilers, in consequence of the accidents which have happened?—I conceive Woolf's mode of constructing boilers to be a considerable improvement; a very material one I have likewise been told, though I have never seen one, that Trevethick has invented; a method of making boilers by increasing their length and decreasing their diameter, so as to render them capable of sustaining pressure to a much greater degree than heretofore.

Have more accidents occurred since the invention of the high pressure boilers, than might have been expected from the invention of any new system whatever in the mechanical construction of engines?—Perhaps not.

What

What expansive force of steam is generally employed in those high pressure engines?—I fancy that is very variable, from 30 pounds to 120 upon the square inch, or even perhaps higher than that.

Instances have been known in which a boiler has been worked at 160 and 180; have there not?—I have heard of such things, but I never knew of them.

What is the proof to which high pressure boilers are generally exposed previous to their being used?—The most eligible proof they ought to be exposed to, is by water.

To what pressure?—I should think double the pressure to which they are intended afterwards to be subjected.

What is the estimated force in your opinion, which would burst a high pressure boiler of the best construction?—That is very different, because it depends upon the strength and construction of the materials; I never entered into the calculation.

Have not the greatest advantages been derived to the mines and manufactures from the use of the high pressure boilers?—I believe inestimable advantages.

Have you any doubt that Cornwall has derived an advantage which may be considered as incalculable from them?—None in the world.

Do you think, from the few accidents which have occurred in the use of them, there is any better argument to be brought against the permitting them to be employed, than could be derived from the accidents which have arisen in the explosion of gunpowder in the clearing passages in the mines?—No, not as applied to the mines, certainly.

You have mentioned that security is afforded to the engine by feeding the boiler by a column of water; from what does that security arise?—The pressure from the steam in the boiler could never rise to a force greater than that which would be equal to the pressure of the column of water; whenever it did arrive at that pressure, or beyond that pressure, the water would be blown out and the steam would follow.

You have stated, that in the steam vessels used upon rivers, this precaution is not resorted to?—I never saw one, and it would be extremely inconvenient.

For what reason?—On account of the undulations the water would be subject to; it would be thrown out of the pipe from the motion of the vessel; and other inconveniences would arise, such as bringing the pipe through the deck of the vessel.

Do you apprehend, that a mercurial gauge would be exposed to the same inconveniences?—Certainly, I do; the altitude would be lessened by every new assumed position of the vessel; that is, if a tube placed vertically at first, should by the action of the vessel assume a diagonal or an oblique position, the altitude of the column would be lessened, and its consequent pressure upon the steam lessened.

Are you of opinion that there would be much difficulty in guarding against such an inconvenience as that?—Yes, I think there would, generally speaking; but a well constructed safety valve would answer all the purposes.

Are not the safety valves applied to the low pressure engines, even when the column of water is used to supply the boiler?—Most frequently they are; I have seen some without.

Did you never hear of the pressure in a condensing engine being raised by mismanagement as high as 19 or 20 pounds per inch?—No; I do not recollect that I ever met with such a circumstance; I have no doubt that it has taken place.

If such a circumstance may take place with a low pressure engine, do not you think, that according to the general calculation of the strength of their boilers to resist the usual pressure to which they are subjected, more danger would arise than in almost any case which could happen to a high pressure engine with a boiler properly adapted?—No, decidedly not; according to the general construction of low pressure boilers, they are so rivetted together to withstand the low pressure they are intended to bear, and they always give indications of an increase of pressure long before I should apprehend any danger from it; I mean by the joints giving way, and the steam forcing a passage through them.

Do you mean to apply that to the cast iron boilers?—No, certainly not; to the wrought iron or copper boilers.

The question before put was meant to apply to a low pressure engine, fitted up with a cast iron boiler?—As applied to the cast iron boiler, I should say, that, being constructed to bear a less degree of expansive force, an explosion would sooner take place, and therefore would be less dangerous.

Mr.
Bryan Donkin.

Less dangerous in comparison with what?—With a high pressure boiler.

Do you mean to say, that an explosion of the cast iron boiler of a low pressure engine which should be burst by an improper degree of pressure, would be less dangerous than the rending of a wrought iron boiler, occasioned by a much higher degree of pressure?—I gave my answer as connected with the former question, with regard to the liability to danger from low pressure boilers; I take for granted, that if a boiler is constructed to be applied to a low pressure engine, that a commensurate strength will be applied to the materials of the boiler, and that in the case of applying a boiler to a high pressure engine, an adequate strength must be used there to the pressure intended; therefore, if the low pressure boiler by any accident should be exploded, generally speaking, boilers made of the malleable metals must be much safer on an explosion taking place, at least they are not calculated to do so much mischief as the cast iron boilers.

Have you made any experiments, or are you acquainted accurately with the effect of such as have been made upon the different quantities of fuel consumed in the high and the low pressure engines, in proportion to the quantity of power produced?—I have witnessed several experiments on Woolf's engines, where the object was to ascertain the comparative expenditure of coals or fuel in grinding corn between his engines and the low pressure or condensing engines, and the results were decidedly in favour of Mr. Woolf's engines.

You cannot speak as to the high pressure engines commonly in use?—I apprehend there is no saving of fuel, or very little; there may be a little.

What was the saving of fuel by Woolf's engine, as compared with the other?—The average effect in one case was the grinding eighteen bushels of wheat with one bushel of coals; the other average effect of Bolton and Watt's engine, or the low pressure engines, is the grinding of from ten to twelve bushels of wheat with a bushel of coals.

Do you know whether the power of the engines in lifting water, may fairly be reckoned at the same proportionable difference?—Yes; I believe they may. I do not speak from experiments; but I have no doubt as to the effect; by the reports from Cornwall, I am led to suppose it may be much greater.

Have you seen any account of the explosion of the steam engine on board a boat in America, within a few weeks past?—No; I have not. I understand there has been one.

From any information you received at Norwich, did you hear of any conduct of the manager of that boat, which occasioned the explosion of the boiler?—No; the information I did receive upon that subject, was since we returned to London.

Seth Hunt, Esquire, called in; and Examined.

Seth Hunt,
Esq.

ARE you concerned with the province of Louisiana?—I have been in Louisiana; I formerly was commandant in Upper Louisiana.

Can you furnish the Committee with any information in respect of the safety of steam boats?—In the United States a great number of steam boats have been established:—The first was at New York; there are now running between New York and Albany, ten boats; two between New York and the State of Connecticut; four or five to New Jersey; besides the ferry boats that pass and repass across the river, of which there are four; those boats work all by low pressure engines; no accident has ever happened to any one of them; they have been running since the year 1807; and the boats at Albany perform about forty trips each per annum.

What distance is that?—An hundred and sixty miles. They go up in twenty-one hours, and come down in nineteen; sometimes a little longer, but never shorter than nineteen; that is the quickest passage.

At what rate per hour do they go?—Some of them go about seven miles an hour in still water; some boats have gone nine, ten, or eleven knots; but that is under particular circumstances. They have come from Newhaven to New York, ninety miles, in six hours and a half, without any sail.

Do they ever make use of a sail?—They have a sail and a mast, which they can lower down and raise up to take advantage of a favourable wind, to assist them in their passage.

Those boats are upon rivers?—Those which go to Albany pass up the North River, and the others to Connecticut pass through what is called Long Island Sound, which is forty miles broad in one part of it. On the river Delaware there are a number of boats also established, which ply between Philadelphia and Trenton, in New Jersey; and Philadelphia and Bordenton, in New Jersey; also

also others between Philadelphia and Newcastle, and Philadelphia and Wilmington; beside ferry boats which pass and repass the Delaware. Several of those boats have low pressure engines, others have high pressure engines, working the high pressure engines from 100 to 140 pounds the square inch, and as high as 160; but those engines are constructed upon Oliver Evans's plan, called the Columbian Plan.

Are they of wrought iron?—Yes; there are no cast iron boilers in America. I presume that may arise from their not having founderies in which they can cast them sufficiently large; they are all wrought iron boilers or copper; all which have to pass through salt water are copper. The boat Etna, which passes between Philadelphia and Wilmington, is a high pressure engine, and outstrips all the other boats; there is no competition at all between them. There are boats which pass also on the Chesapeake, which is there forty miles wide; they pass from Baltimore to French Town and back, regular boats, two lines of boats; one leaves Baltimore one day and the other the next; they pass every other day alternately. There are other boats from Baltimore, which go to Norfolk; there they pass a still wider part of the Chesapeake, which may be sixty miles wide; they have been to New London, which is still more exposed; and have been up to New Hertford.

Are those with high pressure engines?—No; low pressure. On the Potowmac there are also steam boats, and on the James River, which pass between Richmond and Norfolk.

Have any accidents been known to arise on account of the heavy seas?—No; no accident whatever. I have not mentioned the most important circumstance connected with this:—the Powhattan steam boat was built at New York, went into the open ocean, encountered for three days a very severe gale of wind, arrived safe at Norfolk and up to Richmond. The gentleman is now in England who navigated her; and I have heard him say, that he felt himself as safe as he should in a frigate; and he said there was this advantage, that the steam power enabled him when they could not have borne sails, to put the head of the vessel to the sea, instead of lying in the trough of the sea, being exposed to be over-run by the waves.

What was her tonnage?—Two hundred and fifty tons.

What is the largest steam boat in America?—The largest I have seen are those on the Mississippi, the Etna and the Vesuvius, which ply between New Orleans the Naches; they are 450 tons, and they carry 280 tons merchandize, and 100 passengers; 700 bales of cotton besides the passengers, are transported to New Orleans.

Have you any regular allowance of power according to a ton?—I believe that after they have proved their boilers, which I presume should be done in all cases, if they wish to ascertain the pressure, they work with safety at half that which it has been proved at.

Is there any rule according to tonnage established as an usage?—I am not an engineer, and am not conversant with that subject; I have passed through the country, and have been on board most of those boats, but I am not acquainted with that fact.

Have any accidents happened?—Within my recollection only three accidents have happened to steam boats in America; the first happened on the Ohio, and was occasioned, as stated by the public papers, by the negligence and inattention of the engineer, who loaded the safety valve, and neglected to attend the fire; all hands were engaged in hoisting the anchor, the fire was in a very high state, and of course produced a vast deal of steam that did not escape by the ordinary operation of the engine, which would discharge it and carry it off.

What is called the safety valve had been improperly loaded and neglected?—Yes, but that never need happen; the principle of steel-yards is to put a weight at the end, and if you put no more than that, it will answer its purpose;—so with a steam engine; it may be overloaded, and its effect destroyed. The next accident happened, not from a fault of any body, but from an act of God; it was lightning, as was satisfactorily explained to the public, both by the passengers and those interested in the boat; that was at Charleston in South Carolina; the pipe which carries the smoke up to the top attracted the lightning, and it went down and split the boiler.

It was not considered as at all connected with the operation of the engine?—No, not at all through negligence; a third accident happened lately to the Powhattan; she was not in operation when it happened; they were out of fuel, they stopped their boat and lay still upon the water while they went after wood;

Seth Hunt, Esq.

still however they kept up their fire, and the steam was high and it exploded in that situation, there being no consumption of the steam as it accumulated. Those are the only accidents that ever happened, except such as have happened from vessels taking fire.

Were those vessels high or low pressure engines?—All low pressure engines. No accident has ever happened in America to a high pressure engine, either in a manufactory or out of it; and there are many engines used in the manufactories, and in flour mills and saw mills, constructed upon the plan of Oliver Evans, which act on the high pressure principle to 150 pounds an inch; he has worked 160, but 120 is his constant average. There is not an old woman in America that is ever frightened at all at a high pressure engine, any more than they now are at cannon. There is a very large engine, about a forty-five horse power, at St. Sennati, on the Ohio River, which moves seven pair of stones in a flour-mill, a woollen manufactory, and a cotton manufactory seven stories high; it works upon the high pressure, and there are saw mills and grist mills at various places.

What is the fuel?—Wood in most places. At Pittsburgh and on the Ohio River, it is coal and wood; at Pittsburgh and at Weeling, and a hundred other places, there is fifty miles square a solid mass of coal; they drive the shaft horizontally into the hill, and the coal is abundant above their head in the mountains, as fine coal as any in the world; it is delivered at the houses of the inhabitants at sixteen bushels for a dollar.

Is the number of steam boats now increasing in America?—Very rapidly.

Are those that are now constructing upon the high or the low pressure system?—Upon both, because there are different interests and different companies. Mr. Evans being a patentee, they have to give something for the use of his patent;—if they cannot make their bargain with him they use the low pressure engine; but there is a new engine invented in America, a perfectly rotatory engine, built for one-third of the money, which is now coming into use in several of the steam boats; and it was supposed when I came away it would supersede all other engines.

Do you know of any particular guard in the construction of steam engines used in America to prevent accidents?—I know of no other, than that of properly constructing the safety valve, and the manner of loading it, so that they cannot get on more than a certain weight; they must of course construct them strong enough and prove them.

They are under no government regulation?—They are not.

Does that with a rotatory motion consume more coals?—It is supposed to consume less; twelve bushels of coals with the rotatory motion will perform the same work as the other engine with twenty.

Mr. Timothy Bramah called in; and Examined.

Mr.

Timothy Bramah.

YOU are an engineer, at Pimlico?—I am.

You were one of the gentlemen that went to Norwich to inquire into the explosion of the steam boat?—I was.

Did you go at the request of any party, or of your own voluntary suggestion?—I went in consequence of my friends, Mr. Collinge and Mr. Donkin, calling upon me to ask my opinion, whether it would be right for us to interfere upon such an occasion; I concurred with them that it would, and volunteered to go.

Your design was to inquire into the causes of the explosion?—Yes, and to examine as much of the wreck as we could find.

State to the Committee to what you attribute the accident?—The observations I made led me to determine it was owing to the expansive force of the steam, and the inadequacy of the boiler to sustain that force.

Was it a high pressure or a low pressure engine?—A high pressure engine; the boiler was badly constructed and shaped.

Of what materials was the boiler composed?—Of wrought and cast iron, and it was the cast iron part that gave way.

Those two materials expand in a different proportion with the same degree of heat?—Yes, they do.

Is it usual to have the boiler of wrought and cast iron?—I should think it would be avoided on all occasions by experienced engineers; but I have often seen it.

This engine was not made so at first, but altered afterwards; was it not?—Yes, in consequence of the other giving way.

Have you any reason to suppose that the accident might be attributed to negligence or mismanagement in the director of it?—We had verbal testimony,

mony, from which I had no doubt the steam was at a considerable degree of pressure; but the end was very improperly made.

Did you ever learn at what rate the man was working?—No, I understood he was working at 60lbs. an inch generally, probably it might be 120 at that moment; but I should think it not equal to the working of 60, for it was only three-fourths of an inch, and a sixteenth in some places in thickness, and it was four feet in diameter at the end; it was a flat end to the cylinder like a drum.

Is it possible to construct the engines in steam boats in such a manner that there is great improbability of any accident happening?—I do not know how to answer as to their being perfectly safe; I do not feel that materials, when they are submitted to so great a pressure, are safe, for we find that very few materials will stand a great degree of pressure for any length of time; we often find that a water press, which has been efficient six or seven years together, at length gives way, when the metals are subjected to a very great pressure; it is like a blow with a heavy machine for breaking metals, which does not break the first time, but is constantly tending to loosen the particles.

Do you think that a high pressure engine, under any guard that can be applied to it, is a safe engine to use in a steam boat?—I do not conceive it is a proper engine, or a safe one.

Did you ever hear of their having been used with wrought iron boilers with perfect safety?—No, I have not heard of any comparative statement of either the wrought or cast; I know they are usually made with cast.

Do you consider yourself sufficiently an engineer, with respect to the construction of steam engines, to be able to give of your own knowledge, a decided answer to such questions?—Yes, I do conceive so; I have paid a great deal of attention to the subject of steam engines, and I believe I know the principle of every one in existence.

If on a certain pressure in a high pressure engine, a safety valve or safety valves were so constructed, as that they would open and discharge the steam with a pressure much less than the boiler was calculated for, would not such a boiler be perfectly safe, admitting it to be made of proper materials and properly constructed?—Yes, if it could be proved that the boiler was calculated to resist a pressure much greater than that to which it was to be subjected in the ordinary way of business, and that proper safety valves were applied, it would be safe as long as the action of those safety valves were insured, and so long as the perfection of the metal could be upheld.

If a boiler was found to sustain the pressure of 100 lbs. to a square inch, and such boiler had been tried, and it was found, before used, that it would bear a pressure of 200 lbs. upon the inch, would not such a boiler be perfectly safe to be used, if the safety valve was so constructed as to open itself at the pressure of 60?—I cannot pronounce it perfectly safe, and I must give this reason; I think if a boiler was prepared to sustain 100 lbs. and strained to 200, it might afterwards perhaps burst at 40, the straining having injured it.

In the situation of steam boats, might not the unskilfulness of the sort of persons who manage them render any steam boat unsafe?—I do not know how that could be the case; they might by wilful perversion of the proper principle of management render them unsafe to a comparative extent; for instance, if there was half the pressure there would be but half the danger under like circumstances.

Do you or not apprehend, that a boiler upon a proper construction, of wrought metal, may be tried with a certain force, so small in comparison with that pressure which it is intended to bear, as not to incur any risk of being injured in the proof, and have a complete surplus of strength, so as to enable it to be afterwards used without any danger in the use?—I should pronounce such a boiler to be perfectly safe, and so long as it maintained those properties it would continue so.

Have you considered how safety valves may be constructed as adapted to boilers, so as to put it out of the power of the person having the management of them improperly to load them, or to alter their nature?—The most simple mode which has suggested itself to me is, to have a double safety valve, and to lock one up, and to have it examined once a week, or as often as may be necessary, to see that its action is perfect.

If there were those two safety valves, one under the management of the person who had the direction of the boat, and the other safety valve under such guard that he could not prevent its action; such a boiler would, in your opinion, be safe?—That would be more safe than any I have ever seen.

Mr.
Timothy Bramah.

Have you ever witnessed the different effects of the explosion in cast and wrought iron boilers?—No; I have seen wrought iron vessels that have been burst—torn out, as it were.

Did you never see a cast iron vessel burst?—Yes, many; the wrought iron generally tears and opens out, to admit of the fluid escaping; it is generally the fluid which does the mischief when the wrought iron is used, and it is both the fluid and the material which does the mischief when the cast iron bursts; the effect in cast metal is, to carry the pieces of the metal to a considerable distance, which is seldom the case in the wrought, unless where there is any cold shut in the metal; the cast bursts like a shell, projecting the particles of the metal to a considerable distance.

If an accident of that nature happens to a wrought iron boiler, the mischief would probably be confined to the room in which the boiler was placed?—No, I do not conceive that to be the case; I have no doubt, if it had been a wrought iron boiler in this case, the deck of the vessel would have been blown off; the pressure would have been in all places alike, but here it was only in a lateral direction, and the end of the boiler was blown into the river, and by its re-action the boiler itself was thrown into the river on the other side.

You have said, that you have frequently seen wrought iron vessels burst?—Not frequently in our own experience; I have seen copper frequently that has burst.

Have any fatal or serious accidents happened on those occasions?—I have heard of some, but have not witnessed one; the accidents I have observed have chiefly arisen where cast iron boilers have been used.

In the first instance, when wrought iron boilers are used, the injury is sustained by individuals by the fluid escaping?—Yes.

Where cast iron boilers have been used, it has been by the explosion of metal?—Yes; I do not mean to say it may not be by the explosion of wrought iron boilers; it is very difficult to obtain a boiler of perfect metal; and if there are any cold shuts, or other defects in it, it may explode in the same way.

Is copper subject to the same evils?—No; I think it is generally in a purer state; iron is very impure at the best.

Mr. John Taylor called in; and Examined.

Mr.
John Taylor.

WHAT is your profession?—My principal pursuit is that of a manufacturing chymist, at Stratford in Essex; but I have the control of a district of copper mines near Tavistock.

Have those engagements made you perfectly conversant with the nature and application of steam engines?—I have attended to that subject to a certain extent; of late my attention has been called to high pressure steam particularly, being concerned with my brother in a patent for applying high pressure steam to the boiling of liquids, and using it extensively in our own manufactory, both in steam engines and for the purpose of boiling.

Are you acquainted with the accident which lately happened to the steam boat at Norwich?—By report only.

What do you know of that transaction?—I have heard that the plate of cast iron was of inadequate thickness for the strain to be put upon it. With respect to the impropriety of cast iron compared with wrought, we ourselves constructed one of the first high pressure boilers we used, precisely in the same manner with that on board the Norwich boat; the boiler was proved to 100 lbs. a square inch, by the water proof, commonly used with about 40 lbs. pressure, but the cast iron end broke one day with less than 20 lbs. pressure of steam; the fracture being caused evidently by the heat expanding the cast iron end unequally, and being kept from going to the form it would otherwise assume.

Then you are of opinion it would be improper to make one of such a construction?—As far as I at present know, I should say it was. Upon that we altered our boilers, all having been since made of wrought iron only. I have seen most of the high pressure boilers which have been made, except Woolf's. I have seen Trevethick's old construction, which were cast iron; his new construction with his wrought iron tubes. The Wells-street boiler, which blew up, I saw immediately after its destruction; I was surprised to see that it had been made of cast iron, a pan of eight feet diameter therefore extending the bursting surface in the proportion of four to sixteen; it was of unequal thickness, badly cast; cast from small furnaces, and the contact of the iron not complete; it did not meet in fusion.

Was that a high pressure boiler?—Yes, intended to boil sugar; the thickness was intended to be, doubtless, about two inches or two inches and a quarter, but

but by inserting the core unequally, the thickness on one side was three quarters of an inch, on the other side the thickness of the metal was two inches and a quarter, or thereabouts; therefore to the general objections to cast iron was added a most improper construction. I understand from the men who were working there (the Frenchmen) that there had been something like a mercurial gauge attached to it, but that the mercury never fluctuated; it indicated nothing; that the safety valve was loaded down with weights, which we could not collect, and therefore did not ascertain the pressure; but that it was probable there was a pressure of more than 100 lbs. per inch.

Had you ever seen it worked before?—No, nobody was admitted to see it worked.

How many accidents have occurred in the high pressure boiler to your knowledge?—The first I ever heard of was one of Trevethick's at Woolwich.

Was that a cast iron boiler?—It was. In that case the safety valve was a very awkward thing, hardly to be called a safety valve; he himself was not awakened to the danger till that accident happened. The second case that I heard of was in the North, a propelling engine (it was mentioned in all the papers); it was near Sunderland, of a boiler driving waggons; the facts of the case I know to be these, from the engineer who made the boiler.—In the first place, they had a smaller boiler to the same engine; that boiler did not generate steam so fast as the engine could expend it, consequently there was never an excess of steam came out of the safety valve, the engine man therefore with impunity screwed down his safety valve; it was never used. The proprietor of the engine wishing to have more power, ordered a larger boiler, which had the power of generating nearly double the quantity of steam; this was sent, and a caution given by the gentleman not to attach it to the engine till he arrived; but that was not attended to; the boiler was attached to the engine; the man went to work as before, and he screwed down his safety valve, not knowing, that though before he had a deficiency, he had now an overplus; he said he would make a good start of it; the boiler exploded, killed several people, and him among the rest; and the force was remarkable, as shown by the fragments of coal that were driven through the mens clothes or into their bodies from the tram. The Wells-street was the third case; the safety valve was loaded in this case. At Norwich I apprehend the safety valve was loaded. The only other case was in Trevethick's new high pressure boiler, the wrought iron boiler; that, I should say, was something like a boiler formed of two arcs of circles; it burst without doing any hurt, and perhaps the circumstance is not known to ten people besides myself. The people were near it, and it did them no hurt. The reason it burst was, that a man very ignorantly took out bars which he should not and altered its construction.—These are the only instances I know of the high pressure boilers.

Do you consider low pressure boilers as safe from explosion under all circumstances?—Only owing to the column of water that fills them; that is the only reason I consider them as safe.

If they are supplied by a column of water, then do you consider them as safe from explosion?—I do not consider them as absolutely safe, because I know facts of their bursting; in case of their not being fed with a column of water they are very unsafe; for the construction of the boiler is weak in itself, and you have no dependence but upon a safety valve, which may be loaded improperly.

Do you conceive that a wrought iron boiler may be rendered safe under all circumstances?—I do consider that it may.

State how?—Principally by the use of a column of mercury in a syphon or tube, of sufficient size; when that mercury is displaced by the expansive force of the steam, which would be regulated by the height of that tube to admit of the efflux of the steam from the boiler as fast as it was generated by the fire, in that case the expansive force could not increase in the boiler, but the mercury would be blown out and the steam would escape: that I consider one of the best securities to the boiler. Besides the common safety valve, which may be at the discretion of the workman, I conceive it essential to have another safety valve, which is under the control of the master or proprietor of the works. There is another small contrivance, which I consider very important to the safety of the boiler. Boilers have been weakened very much by the water having been evaporated too low, so that the bottom begins to be acted upon by the fire and weakened. A hole having been previously bored in the bottom where the fire acts, may be rivetted by a piece of lead, so that that lead remains perfectly secure as long as it is covered with water, but the moment the water leaves it the lead melts; the steam is blown out through the hole and puts out the fire; besides giving the signal of what is wanted, it at once puts an end to the cause of danger.

Mr.
John Taylor.

Do you consider that the mercurial gauge acts in any other manner than as a safety valve, which cannot be stopped or put out of order?—It does not act only in that manner, but it has the advantage of exhibiting during all times of the boiler's working, the state of the steam within the boiler, by the fluctuation that takes place in that column, as indicated by the index upon the surface of the mercury, and the state of that mercurial gauge is observable every moment. If the mercury becomes stationary, one would strongly suspect that that tube was stopped, therefore it would point out itself instantly that it had become not what it ought to be; the safety valve has not that advantage, as it does not indicate any thing till the steam is blown out by raising the weight.

An observation of the mercurial gauge by an intelligent person, would tend to guard against mischief?—Yes, by *any* person.

What are the different effects produced by the explosion of cast and wrought iron?—As far as I have stated the fact with respect to Trevethick's boiler, which was of wrought iron, a rent or fissure was produced, and the form of the boiler was disfigured, but no fragments were thrown about so as to produce any serious injury.

Do you conceive that to be the usual effect?—I conceive it would be the effect; and I conceive further, that one might predict with some degree of certainty where that fissure would take place; it would take place in that part of the boiler that is most exposed to the action of the fire; that growing thinnest.

Have you ever seen an explosion of a cast iron boiler?—No, I have not; I have seen the effects at Wells-street, I was upon the ruins immediately after; the effect seemed to be tremendous; there it knocked down the whole building, which was a sugar-house of five or six stories high, and fragments appeared to be thrown in every direction; the boiler itself was shattered into a great number of pieces.

If that had been a wrought iron boiler and had burst, it would not have produced the same effect?—I think not.

Are you at all aware whether there is any preference of copper above iron, in the construction of boilers for high pressure steam engines?—I should think that copper is the best metal of all; the most ductile. But I think at the same time, that with good wrought iron, boilers may be made perfectly safe up to the estimated strength of from four to five hundred pounds pressure per inch.

Have you formed any opinion respecting the pressure per inch, necessary to drive a steam boat through the water at the highest rate at which you have heard of any hitherto having gone?—I have not turned my attention particularly to the use of high pressure steam, as applicable to steam boats. But being the owner of a high pressure engine, I see no advantage at present in going above forty or fifty pounds an inch in steam engines.

Supposing then that a boiler were constructed, with the intention of its resisting a pressure of steam equal to 300 pounds per inch, that it should be afterwards proved with a force equal to two hundred, and that it should be after that worked with a pressure under a hundred, do you conceive that any supposable danger could exist under such circumstances?—None at all; provided the steam was limited to a hundred.

It is understood of course, that the common precautions of safety valves, the operation of which could not be impeded, should be applied to such boilers?—Yes; with respect to the valve of high pressure steam for working engines, I beg leave to say generally, that in Cornwall of late a most valuable improvement has taken place; and that if it is an object to save coal to steam vessels upon a large scale, I do conceive that high pressure steam becomes an object of great importance to them. I mean if applied upon the principle that Mr. Woolf has in the first place introduced; but which has been applied by Mr. Sims, and I believe by some others.

You are of opinion these high pressure boilers might be made with equal safety as low pressure boilers?—Quite so.

Do you know any thing of the saving of coal produced by high pressure engines?—I have in my hand a statement of the work done by the engines on the principal mines in the county of Cornwall. It states the consumption of coal, and the work done by every engine therein named, from which it appears that the average work of engines now in the county of Cornwall, is to raise about twenty million pounds of water one foot high, by the consumption of one bushel of coals; that by the introduction of high pressure steam under the best mode of management, an effect equal to from forty-three to forty-five million pounds

pounds of water, is raised the same height by the same quantity of coal, thereby producing above double the effect.

Mr. John Taylor.

Do you apprehend that condensing or low pressure engines are liable to be blown up by the carelessness and inattention of the engineer conducting them?—I apprehend equally so with high pressure engines; and I am of that opinion from facts which have reached me. In France, at Crusoe, some very good engines were erected by Mr. Wilkinson, at a very large work. They were on Bolton and Watt's principle; one of them blew up and killed several people. I have heard of other instances, but they are not within my own knowledge.

Do you conceive that the mercurial gauge may be applied with ease to the high pressure boilers, so as to produce safety, as certainly as the column of water, which is in fact a water gauge, which is usually applied to the low pressure?—I do most undoubtedly think that, provided the mercurial gauge be of a sufficient bore; and I think, in some respects, it would have the advantage of the water gauge, as being less liable to accidental obstruction.

Do you conceive that there is any difficulty whatever in constructing a safety valve, so as to operate with certainty, and to be safe from any impediment which the engineer might intentionally place in the way of its operation?—I do think such a safety valve can be constructed.

Do you apprehend any additional considerable expense would be thereby incurred?—Not any considerable expense; we have done it to all the boilers we have lately superintended the erection of, putting them under lock.

Mercurii, 14^o die Maii, 1817.

CHARLES HARVEY, Esquire, in the Chair.

Mr. John Collinge, called in; and Examined.

WHAT profession are you of?—An engineer and iron founder.

In the course of your profession, are you conversant with the nature of steam engines?—I have made several.

Where do you live?—In Bridge Road, Lambeth.

I believe you are the patentee of the patent axle-tree?—I am.

Did you go to Norwich in consequence of the accident that happened to the steam boat there?—I did, in company with Mr. Donkin and Mr. Brown.

Did you go at the request of any person?—No, it was voluntary, from an impression the public mind would be alarmed, and wish to know the cause of the accident.

Did you see the boiler, or any of the remaining part of that engine?—I did.

Do you attribute the cause of that explosion to the construction of the boiler?—I do.

Be so good as to state what it was?—The boiler was composed entirely of wrought iron, except one end, and that was capped with cast iron.

The cylindrical part was made of wrought iron?—Yes.

It was a high pressure boiler?—It was.

Originally it had all been wrought iron?—It had, I believe.

But upon an alteration they put one end of cast iron?—Yes.

Was not such a conjunction of metals in such a place very dangerous?—Certainly.

Principally because the expansion of the metal is totally different in one and the other?—Yes.

What is your opinion, as an engineer, in respect to the material of which boilers in general should be made?—Any material under very severe pressure is liable to fail, and cast iron for this reason, because in all large bodies we find that the air cannot wholly escape in the act of fusion. I have occasionally had large masses of cylinders and pans to break up, and we find frequently cells where the air could not escape, so that we are never certain as to the solidity of cast iron; there is certainly a much greater dependence upon wrought iron or upon wrought metal; perhaps it would be better to include copper.

In wrought iron there is danger from cold shut?—Yes.

Supposing an accident should happen to any boiler, which would be most likely to be attended with the greatest mischief, a cast iron or a wrought iron

*Mr.
John Collinge.*

Mr.
John Collinge.

boiler?—Cast iron, because cast iron flies off in fragments, and wrought, from tenacity, only rends.

Did you ever hear of an accident in a wrought iron boiler when it has exploded, that has done any considerable mischief?—I was almost upon the point of believing, that wrought iron boilers would have resisted a degree of pressure, if properly made, beyond what I find they will do; because an accident has occurred at Malden, where a boiler, nineteen feet long, was blown off from the seat of its connection with the base. I have found, in making wrought iron boilers myself, that if I make them of metal of a considerable substance, that they cannot be so well united to make them steam tight; it is a very difficult thing to do; how far that is the case with copper, I have no acquaintance, but perhaps it would not be precisely the case with copper; the rivets that are applied to wrought iron boilers are put in hot, and when they are hammered to secure the joint, they get cold, of course they shrink, and do not fill the hole through which they have passed.

The wrought iron boiler which you stated burst was not applied to a boat?—No, for a salt work.

Is it your opinion, as an engineer, that any boiler, whether of wrought or of cast iron, but particularly of wrought iron, could be made by the construction of safety valves, so secure that all danger from it would be almost impossible?—At present I have no conception that any safety valves could be applied to render them perfectly secure under heavy pressure.

Is it your opinion, that if a boiler was originally constructed of wrought iron, to bear a pressure of 100lbs. to the square inch, and that such boiler had been tried by experiments, say at sixty, and that a safety valve was applied to it which should open at a pressure of thirty, such a boiler would be liable to be exploded?—Not unless it had been previously strained by the experiment to render it too weak.

Cannot a safety valve be so made that it shall open, and be certain to open at a particular pressure?—The safety valves ought always to open at that pressure, but from causes that we cannot ascertain, that does not happen in cases where accidents occur; it is to be hoped that safety valves will be contrived to answer for high pressure engines.

Would it not be possible to apply to such an engine as that a tube with a column of mercury?—Yes, and it would be a judicious application; but it requires such an altitude, I apprehend it is not very easily applicable to boats from the agitation of the vessel; but if it could be applied, it is the best application that can be made.

In the low pressure engines the general safety is by a column of water?—Yes.

That could not be used on board a boat?—No.

Then you think the mercurial gauge would be the greatest safety for a boat, if it could be applied?—Certainly; if it could be judiciously applied, it possesses greater safety than any other.

Have you seen steam boats on the Clyde or Humber?—No.

You know those on the Thames?—Yes.

What is the greatest power that would be required?—The condensing engines should not be more than four pounds to an inch; and if the capacity of the vessel allows of it, the condensing engines answer every purpose, because you can have one on board more than sufficient for the tonnage; because the making a wrought iron boiler would be on such a scale of thickness, that if more than the usual pressure was applied, the rivets would fail and constitute a security against any fatal occurrence.

Could not a boiler then be made for what they call a high pressure engine, equally safe?—I should apprehend not, for the reasons I have stated; I have made several boilers, and I find if the plates are thick beyond the dimension usually employed for condensing engines, that they do not prove equally steam-tight.

Explain whether you mean the plates or the seams?—I mean that the seams are not equally steam-tight.

Did you from any report you heard, besides the bad construction of the boiler at Norwich, discover that any negligence was imputable to the direction of that engine?—It was presumed by report that he was imprudent frequently; for the purpose of impelling his vessel with greater force, that he did load his engine too much.

Did you see any body who had escaped from that accident who was on board the boat?—I did not.

If

If there was too much weight added to the valve, would not that occasion the explosion?—There is no doubt that was the case; but a much smaller degree of pressure would have burst a boiler so constructed.

Mr.
John Collinge.

Then if a boiler had been made properly, and a man had been so imprudent as to have loaded the safety valve, the same accident might have occurred?—Certainly.

You have said, from the power that was wanted with regard to steam boats, you thought condensing engines were the best engines applicable for that purpose?—I think so, no doubt.

Do you mean the best as applied only to safety or for use?—For safety only.

But if a high pressure engine could be made with equal security, would not that be more convenient to be used on board a boat than a condensing engine?—It would take less room.

Would not it in many cases, as they are now constructed, consume less fuel in proportion to the power?—I am not acquainted with that fact; but I have frequently asked, and I find in the common high pressure engine there is no saving in the fuel, but they are cheaper and more simple in their construction.

Do you apply that to the high pressure engine which they call the Trevethick engine?—Yes.

Not to any other?—Not to Woolf's.

Nor to Simms's?—I have never seen either one or the other.

Suppose that a high pressure engine was to be used in a boat, what construction of boiler or safety valve applied to that boiler should you advise, in order to give it the greatest possible security?—I really am unable to answer that question satisfactorily; of course the more safety valves there are employed, the greater security there will be against the chance of explosion; I believe that the principal source of the explosion of high pressure engine boilers of cast iron, arises from allowing them to get cool too suddenly, and raising the steam too suddenly, the metal contracts and expands at a period when we cannot investigate its occurrence.

Wrought iron would not be attended with that danger?—Not to the same extent; the rivets would go.

But not with the same degree of explosion?—No.

Would it not be a great safeguard in the construction of a boiler, if a safety valve was so made as to be put out of the power of the engineer to get at it?—No doubt, it ought in all cases to be so.

It could be so constructed?—No doubt; if the pressure, however, is greater than what the safety valve is intended to relieve, there might be an accident from the causes which I previously stated, that is, that a boiler might be defective without its being known.

You apply that to cast iron boilers?—Yes, and in a small degree to wrought iron boilers.

Do you conceive it impossible, or even difficult, to construct a wrought metal boiler, with safety valves properly adjusted to its capacity, and a mercurial gauge, supposing that to be capable of being applied, which should render a high pressure engine on board a steam boat what might be called perfectly safe?—No, I do not think it impossible, and I hope some time or other it will be accomplished.

Wherein do you apprehend that the difficulty of so constructing a boiler would consist?—Because I have found that difficulty in making boilers myself steam tight, even for condensing engines, where the plates were of a thickness fit to undergo high pressure.

Do you apprehend that any danger of a fatal accident could arise from that mere want of tightness in the rivetting, which would permit some steam to escape?—That danger would depend upon the degree of the pressure, and the extent of the aperture through which the steam escaped.

What is the species of danger which you would expect to occur in such a case?—I am not able to answer the extent of it. If the safety valves acted, of course the danger would be removed; supposing that the safety valves are properly constructed, and their operation is secured, the danger would not be extremely great; it is only from their defect of action that the danger is to be apprehended.

Then do you mean to say, that if the valves were really in point of fact performing their functions properly, in that event you would not consider there was any danger?—Certainly not, if the boiler was adequate to the pressure.

Mr.
John Collinge.

What is the pressure per inch which you conceive to be generally used in the condensing engine?—From two and a half to four lbs.

Do you not apprehend that the strength of the boiler is calculated upon what may be required to resist that low pressure?—Yes.

Is it not extremely possible, in the common use of a condensing engine, that by accident or the inattention of the engineer, the pressure may be increased very much beyond that which you have just mentioned?—No inattention would produce it while these securities exist; because the water would be discharged through the feed pipe, and the mischief prevented.

Did you ever know the steam pipe used in any condensing engine on board a steam boat?—I fancy they never are.

Did you not hear that the Norwich boiler was blown up by the very fact of the inattention or temerity of the engineer?—I did hear that.

Is not that inattention or temerity equally to be applied to a condensing as to a high pressure engine?—The engineer may tie down the valve occasionally; it is very natural to expect it in steam boats. I fancy it is too frequently done; there are instances where something of that sort was said in conversation at Norwich, that where a man waited for passengers, and wanted to get up with the other boats, he did it.

Could a mercurial syphon be applied to a boiler, so that it would meet the observation of all the passengers on board the boat?—I should think it could; but the discharge of mercury, in case of explosion, might produce very serious effects.

If the syphon was of a sufficient bore, it would be the means of preventing the effects you have spoken of?—No doubt.

In order to give security to the public in travelling by steam boats, do not you think that it might be necessary to have an examination of each engine two or three times in a year?—Certainly; once every six months. I think it would create confidence, and that is a great object.

And that is your opinion, whether the boiler is constructed of cast iron or wrought metal?—Yes.

You think that without this examination a condensing engine would be unsafe?—I think it would be advantageous to have an examination.

In your judgment, would an inspection of the boilers of a steam engine, of a condensing engine, and an high pressure engine, be equally necessary, with a view to give security against accidents by explosion?—Yes; both.

Do you think any danger to lives is to be apprehended from condensing engines without examination?—I do not think any material danger would arise.

Mr. William Chapman called in; and Examined.

Mr.
William Chapman.

WHAT is your profession, and place of abode?—My profession is civil engineer; my general place of abode is Newcastle upon Tyne.

Have you, as engineer, turned your attention to the construction of steam engines for steam boats?—As to steam boats I have not particularly; but I have been concerned in steam engines of every description, from being connected with the collieries, where we have many engines.

Have you any steam boats upon the Tyne?—We have.

Have you seen those steam boats?—Yes; I have.

How many have you?—I think it is three; but I have only been in one of them.

Do you know the construction of the steam boats employed upon the Tyne?—Low pressure condensing engines.

Are you aware of any reason which would render it expedient to forbid the use of high pressure engines on board steam boats?—I look upon all engines, whether high pressure or low pressure as dangerous to the passengers, unless due precaution be taken to emit the steam when exceeding a given pressure; for in low pressure engines the boilers are always liable to burst or to alter their form, when the pressure becomes superior to the resistance; all boilers but those that are cylindrical in the section, and with hemispherical ends or portions of spheres or cones or conoids, are liable to alter the form by the natural expansive force of the steam, and therefore all boilers but of those forms owe their safety to their weakness, because if weak they will alter their form without danger, and if strong, they have been known to bend the iron so abruptly as to break asunder.

Are

Are you speaking of wrought or cast iron?—I speak of wrought iron; and consequently they explode, and in many instances have destroyed several of the passengers; they are so far more dangerous to the passengers, that they frequently scald them, and do not actually kill them; there are a description of engines in use in the counties of Durham, Northumberland, Cumberland and York, that are termed loco-motive engines; the form of their boilers is cylindrical, with curved ends.

Mr.
William Chapman.

Are those applicable to boats?—Certainly; they are high pressure engines working with a force of from fifty to sixty-five pounds per inch, and no accident has happened to any of them but to one, the safety valve of which was stopped by a man sitting upon it or holding it down purposely; he said, We will have a good start and surprize them, we will go off so well;—the consequence was, that the boiler blew up and killed and wounded a very considerable number of people; I believe to the extent of forty-five, but I am not certain.

Was that a cast or a wrought iron boiler?—It was wrought iron.

Can you suggest the means by which a high pressure engine can be rendered safe on board a vessel?—It can only be rendered safe by having the form of the boiler, such as I have described, and the cylindric part of a limited diameter, with a competent thickness of wrought metal, either iron or copper, and the plates secured to each other by a double line of rivets; it is also requisite that there should be two safety valves, each laden with any determinate weight per superficial inch of the narrowest part of the seat of the valve; one of those valves should be at perfect liberty to be raised at the pleasure of the manager, because sometimes it is expedient to raise it; the other should be under a cover of such description as not to be opened at all, at the discretion of the engineer, but with sufficient apertures for the emission of the steam, and for any of the passengers to see that the valve is not made fast. It is also requisite that there should be a mercurial gauge of not less than an inch in diameter, and whose longest limb shall not be greater than two inches and one eighth for every pound per inch upon the safety valve; it is necessary by occasional inspection to take care, that the mercury does not stiffen by oxydation occasioned by the heat and motion to which it is in a slight degree liable.

Do you conceive that a high pressure engine thus guarded might be used on board a steam boat with safety to the passengers?—Yes, so long as the boiler is kept in order; but the boiler's bottom is liable to erode or consume by the action of the fire, and therefore requires watching.

How long do you think a boiler would last under the action of fire?—A boiler may last twelve months safely, provided its bottom be made of charcoal iron, beat not rolled, because there is a great deal of difference in the grain.

Would you not always recommend a boiler to be made of wrought metal on board steam boats?—On board steam boats I would recommend them all to be made either of copper or charcoal iron plates beat under the hammer and not rolled; the resistance of cylindric boilers will be in the inverse ratio of their diameters.

Mr. Philip Taylor, called in; and Examined.

WILL you be so good as to state what is your occupation?—A manufacturing chemist.

Mr.
Philip Taylor.

Where do you reside?—At Bromley in Middlesex.

You are conversant with the nature of steam engines?—My attention has been directed to the use of steam from a desire to apply it in my own business, not as a moving power, but for the purpose of communicating heat to different fluids, for which purpose I have required high pressure steam. I have a patent for a mode of applying high pressure steam to vessels of the largest capacity; and as in this case all danger depends on the construction of the boiler, I should wish to say a little on those boilers which I have found to be the most trust worthy. I come quite unprejudiced as to any material, and as to any form, for if I could meet with a boiler which would answer the purpose I have in view better than that now used by me, I would adopt it; therefore I shall give the Committee only such facts as have come within my own immediate knowledge. I have no wish to recommend any particular construction.

Will you be so good as to state from your knowledge, what species of boiler for a high pressure engine you would recommend in regard to safety?—I consider the first and most material point to attend to in the construction of high

Mr.
Philip Taylor.

pressure boilers is, that the diameter of such boilers should be small in proportion to their capacity; and that as small a proportion of the external surface of the boiler as possible, should be exposed to the destructive action of the fire; and that the portion of the boiler so exposed, should be so situated and guarded, that in case of explosion the least possible mischief would arise. In those boilers which I have made use of, no portion of the boiler is exposed to the action of the fire without its being constantly covered with water; and the fire is applied under an arch of not more than two feet and a half in diameter; this provides against any extensive rent taking place in the event of explosion. The boilers I have generally employed, are constructed of malleable iron, commonly known by the name of charcoal iron, rivetted together and secured by strong wrought iron belts. From observing the danger arising from the introduction of flat cast iron ends, I have terminated the ends of the boilers by wrought iron ones, nearly hemispherical; this mode of construction, as far as my experience goes, combines more strength and durability than any other. The precautions I have made use of to guard against the misuse of such boilers, have been by adapting to them two safety valves; one under the controul of the engine man, the other secured in a strong cast iron case, locked down and loaded with such a weight as would suffer the steam to escape when it had arrived at an improper degree of expansive force. In order to add to the security given by safety valves, I have likewise in every instance attached to the boiler a mercurial column, the bore of which is proportioned to the size of the boiler; and I should consider an iron tube of an inch diameter sufficient to guard against accident, when applied to a boiler four feet in diameter and twenty feet in length, because the limit given by such a column has always been far within the limit of absolute safety. The length of the external limb of the mercurial gauge has in all cases been proportioned to the strength of the boiler and the force to be applied, taking care that the expansive force of the steam would displace the mercury long before any dangerous expansive force would arise. In order to guard against the boilers being injured by the action of the fire, from a deficient quantity of water in the boiler, I have inserted a leaden rivet in such a situation that it would melt as soon as it was uncovered by the water, and produce an opening which would suffer the escape of the steam. Although I have made use of boilers of this construction, I consider cast iron boilers safe, provided their various parts are made of small diameters in proportion to their capacity; such for instance as those constructed by Mr. Woolf.

From your knowledge of the subject, do you think you can take upon yourself to say, that a high pressure engine with a boiler constructed on the principles you have just now detailed, would be completely safe for the use of passage boats?—I think equally safe with those called condensing engines, because a greater attention to strength is always paid in the construction of high pressure boilers than in the construction of low pressure boilers, in proportion to the pressure they have to sustain.

Have not very great improvements been recently made in high pressure engines, by which the general mining and manufacturing interests of the country have been greatly benefited?—I think very important ones; the high pressure engine, as constructed by Mr. Woolf, employs not only the expansive force of the steam, but also that power which is acquired by its condensation; and the effect in Cornwall has been, that engines on this construction have done double the quantity of work with the same quantity of fuel.

Does your own experience lead you to conclude, that the high pressure engine in general is less expensive in point of consumption of fuel?—If well constructed they are decidedly economical engines with regard to the consumption of fuel.

You mean then by this, that the advantage of the high pressure in point of economy in fuel is not confined to engines of any one particular construction? Certainly; I mean it is not so confined.

Have you any connexion whatever with Mr. Woolf?—None whatever; I am not personally known to him.

Have you any reason to suppose that the high pressure steam engines are already arrived at the degree of perfection of which they are susceptible?—Certainly not; Mr. Woolf's engine has been much simplified since its first invention, and my opinion is, it will be still further improved.

You would then consider any measure which should tend to impede the use of high pressure engines to be injurious to the country?—Certainly, I should.

Jovis, 15^o die Maii, 1817.

CHARLES HARVEY, Esquire, in the Chair.

Mr. *William Chapman* was again called in at his own request, and stated, That when he was asked as to loco-motive engines, he omitted to say that the diameter of their boiler was in general four feet, little more or less; that many of them are formed of cast iron, and several of malleable iron, and that the ends of several of these latter are of cast iron curved outwards; that in no one of them does the fire act upon the external part of the boiler, but is placed in a malleable iron tube which passes through the boiler; a cast iron boiler, however, being found far too heavy, the new loco-motive engines are always supplied with malleable iron boilers.

Mr.
William Chapman.

Mr. *Henry Maudeslay*, called in; and Examined.

WHAT is your profession?—I am an engineer, residing at Lambeth.

You construct steam engines?—Yes, a great many.

Mr.
Henry Maudeslay.

Are you at all acquainted with the circumstances attending the explosion of the steam engine at Norwich?—Yes, I am.

Have you been there since this accident?—No.

Did you know the steam boats there before the accident?—Yes; because I made a steam boat for Yarmouth.

Was the steam boat you made, a high pressure or a low pressure engine?—A low pressure engine.

Will you be so good as to tell the Committee, what is your opinion with regard to the proper construction of those engines, to secure the passengers on board those boats?—I never considered high pressure engines were applicable to boats, because the purpose of a high pressure engine is to save water, and water cannot be wanted on board a vessel; the difference between the one and the other makes no saving either in the weight or expense, taking it ultimately, particularly when steam boats are properly contrived. As far as my opinion goes as to steam engines and steam boats, I would not go from here to Margate in a high pressure boat, because there are many reasons why that may become much more dangerous, and no more advantageous to the public generally or to the individuals. A low pressure engine is of very high power; a high pressure engine has a higher power in proportion to its height of steam. It is pretty well understood, that a gentleman who engages in a steam boat company seldom attends to the engine himself, but leaves it to his men. I built the Regent steam boat last summer with a low pressure engine; there was a dispute between two men, and one of them swore that he would blow his boiler up, but he would beat the Regent in coming up. The man certainly did exert himself as much as he could, and kept his steam as high as he could get it, and it flew out of the safety valve very frequently, and he hurt his boiler materially from doing so, but he did not beat the Regent; but if it had been a high pressure engine, he would either have beat her or blown up his boiler, because he had the power in his own hand.

Had it been a high pressure engine, and the boiler properly constructed, with sufficient safety valves adapted to it, the operation of which the man could not impede, would it have been liable to accident?—I feel some difficulty in answering such a question as that, because I am afraid that there are so many technical terms in engine making, and reasons why safety valves should be attended to, that I doubt whether they would not go to more evil by the man not having access to them than by their being open to him.

If there was one safety valve which was not accessible to the engineer, and another which was, would not that danger be prevented?—I would beg to explain, by saying, that on board the Regent, which has a large boiler, I found it necessary to have two safety valves, and sometimes I put three safety valves; to make it quite easy for the man to move the valve, I have a sort of bell pull going down to the place where he stokes, to pull it up every hour if he pleases, to keep it in action, because it is clear the spindle may corrode and stick fast for want of use. Supposing it not touched once a week, it is not a safety valve any longer, because a very little friction will add a great many pounds weight to the opposition the steam ought to meet with.

According to your experience and knowledge, would a low pressure engine

Mr.
Henry Maudeslay.

be safe in most cases that can occur?—I never knew a low pressure engine unsafe, but it appears that high pressure engines have been.

Would a high pressure engine, under the same circumstances, be equally safe?—Certainly not.

Do you conceive there is any difficulty in constructing a safety valve in such a manner as that the engineer shall be able to keep it in constant fitness for its action, without having a power to fasten it down and prevent it from acting?—I conceive that the same motive which would induce the engineer to work it with an improper pressure, would induce him to leave it untouched, that it might have an improper pressure. I beg to state, that there is not that difference between a high pressure and a low pressure engine, as to its power, that is generally supposed; because it is understood, that the steam in the boiler is kept at from four to six pounds upon the inch, but from two and a half to four is quite abundant for any use a low pressure engine can be wanted for; then, if an engine is in any thing like working order, there is a vacuum formed by the engine itself, by the construction, that causes an addition of ten pounds the inch. On the lowest calculation, those two added together, make fourteen pounds; if you take high pressure steam at forty pounds the inch, you do not, in my opinion, get additional force in proportion to the risk incurred; because we well know, that if the boiler be of cast iron, faults will unavoidably arise in casting which you cannot see, which cause explosions or breakings, and which could not be calculated upon.

Is there any thing which prevents the engineer from fastening down or overweighting the valves of a common condensing engine?—It would be folly for him to do so.

Is there any thing which prevents him?—Certainly not.

Supposing the valves to be so fastened down, does not the engine immediately become unsafe?—Yes, certainly it must; but it would be folly to fasten it down, because, if the engineer be at all acquainted with his business, he must know, that if the steam be raised beyond five or six pounds per inch in a condensing engine, the power of the engine will not thereby be at all increased; the condensing property of the engine does not consist in a higher pressure of steam.

What is your opinion as to the comparative safety of cast and wrought metal used in boilers?—I consider that wrought iron is extremely safe, compared to cast iron.

Then at all events, it is your opinion, that in steam boats boilers of wrought metal should be used in preference to cast?—No doubt about it.

Do you think there is any material difference between the use of copper and wrought iron?—No, excepting in the greater degree of corrosion to which iron is liable.

Are you aware of there being any considerable difference in the consumption of coals, necessary to produce any given power in condensing and high pressure engines?—I consider that the one will work with as little coal as the other; in all high pressure engines and condensing engines I have heard of, I find little or no difference, and those who have them tell me they burn as much coal in the high pressure engine as in the low pressure engine. I have understood that Woolf's engine does save coal.

Do you know that to be the fact?—I do not, because I never attended any experiments; but I have heard it from so many people that I cannot but believe the fact is, they save coals.

If a high pressure steam engine had a wrought metal boiler, either of iron or copper, constructed by a competent engineer, with safety valves in proper order, and a mercurial gauge, should you then think yourself in any danger in a steam boat propelled by such an engine?—Certainly not, if a competent person had the superintendence of it.

Mr. Alexander Galloway, called in; and Examined.

Mr.
A. Galloway.

WHAT is your profession and place of abode?—I am a mechanist and engineer, residing in Holborn.

Do you know any thing of that paper [*showing a paper to the witness?*]?—I have seen it.

Do you know by whom it was published?—I do not know, I have heard it was done by the proprietors of some of the steam boats; the letter I wrote was sent to the Morning Chronicle; it was only within the last three days I saw it in that form.

Have

Have you been employed at all in constructing steam engines for steam boats?—I have not.

Mr.
A. Galloway.

Were you acquainted at all with the accident at Norwich?—No; but what I have heard.

The object of this Committee being to insure the safety of the passengers on board steam boats, will you favour them with your opinion as an engineer, what means are best adapted to insure that safety?—I should certainly recommend, that for steam boats, the condensing engines should be used in preference to high pressure engines, and I will give you my reasons why I do so. In the first place, the great advantage that has been promised from a high pressure engine is, that it can be worked in a situation where water cannot be procured, and therefore, under this circumstance it is for such a situation a valuable machine; but in situations where water can be readily procured, it is not so. And in reference to the comparative price between a high pressure engine and a low pressure engine, and in reference to the space that it occupies, and in reference to the superintendence that it requires, I am decidedly convinced no economy is produced. Speaking to it as a matter of safety, it will be necessary for me to say, that experience has fully proved, that the maximum of force to be obtained by a condensing engine, is when the steam is rarefied from three to six pounds on the inch, the engine is by far more efficient than when the steam is rarefied up beyond; and it will appear equally clear, that whether it be a cast iron boiler or a wrought iron boiler, or a copper boiler, the force of the engine is better performed by steam at three pounds and a half, than it is at any increased expansive force; the boiler being subject only to three instead of six pounds, it must be less liable to explode or burst at that than at an increased expansive force. I should further say, that every man that is called to work a condensing steam engine, knows, that when his steam is at three pounds and a half, it performs a greater quantity of labour than at any other time; for if you increase it you throw a vast labour on the air pump and the condenser, and retard the engine; therefore, a man has no inducement to increase the expansive force of the steam, he knowing that no useful end can be obtained by so doing, but giving himself additional labour and consuming more fuel, and performing less work. I should also wish to state, that I yesterday made a sketch of what appeared to me to be a proper and efficient boiler for a steam boat, without reference to the character of the engine at all, whether it was a condensing or high pressure engine. All boilers on board steam boats should have the fire in the interior of the boiler, because it is of very little importance when you are upon the subject of safety, whether the passengers are to be endangered by an explosion, or whether the vessel is to be weakened in its timbers or essential securities, by the improper application of the fire to the boiler; therefore, I invariably recommend, that the fire should be contained in the interior of the boiler, and that there should be an additional safety valve, which should be solely subject to the superintendence of the proprietor, and that the manager of the machine should have no possible access to it.

That you mean to apply, whether high pressure or low pressure boilers are used?—Both; because I am quite aware, that if a boiler in a steam boat is to have the fire to operate upon it externally, although you may not explode the engine, you may so far destroy the vessel that carries the engine by burning its timbers, without the knowledge of the individuals to whose care the boat is intrusted, as to be highly injurious and mischievous to the safety of the passengers. I should certainly recommend a wrought metal boiler in preference to a cast iron boiler; and the reason is clear, that the operation of casting, however skilfully managed, is always an uncertain process. An occurrence took place a few days ago, which very much staggered me; I had a large press of cast iron, which it was necessary to break up, and in the interior of a bar which was probably eight inches by twelve, there was a cavity in the centre of four inches diameter, with no external communication.

Do you think that a safety valve may not be so constructed, as that its operation shall not be impeded in any degree by the engineer to whose care the vessel is committed, and yet with a tolerable certainty of its operating to all its proper intents and purposes?—If an additional safety valve was applied to a boiler, and that safety valve placed beyond the power of being interfered with by any person but the proprietor, then the boiler would be secure from explosion, if the safety

Mr.
A. Galloway.

valve should be judiciously loaded; but if that safety valve was even placed beyond the reach of the operator, and at the same time injudiciously loaded, a calamity might take place the same as if no such security existed.

Allowing that under all possible circumstances a condensing engine should be the most safe, what is your opinion as to the sufficient safety of a high pressure engine, of which the boiler and safety valves should be constructed in the manner which you have just now described?—I should consider a high pressure engine, under such circumstances using the expansive force to 40 pounds to the inch, and not beyond 40 pounds, would be a safe and efficient engine.

Under all the circumstances which at present exist in the manufacture and management of a condensing and high pressure engine, with a view to the safety of passengers in a steam boat, which of them would you recommend?—Under all the circumstances of the case, I should most decidedly recommend a condensing engine, a condensing engine with a wrought iron boiler; because when cast iron becomes subject to high expansion and contraction, the constant repetition of these effects in a very great degree impairs the strength of the boiler.

That mischief would not be incidental to a wrought iron boiler?—Certainly not. I should venture to say, that all engines in steam boats should be subject to regulation and inspection by competent persons; a steam boat must have a register, and before such register should be granted, the engine should be inspected, to see whether it is of a character to deserve its being considered safe.

What is your opinion as to the expediency of adding a mercurial gauge?—By no means do I consider it an efficient and convenient apparatus on board a boat; it would be constantly in the way, and it would require a great column of mercury to make it safe; and that such a quantity may be liable to do mischief if blown out.

Has it ever happened to you, to form any calculation of the proportion which a mercurial gauge ought to bear to the diameter of a boiler?—I have not; but it will depend upon the expansive force to which the boiler is to be brought up, as well as to the capacity of the boiler; because, if you were to put a mercurial gauge to give merely the pressure on the boiler, that would not be adequate to carry off the quantity of steam that may be generated in a mischievous way.

What is your opinion as to the comparative consumption of coals in condensing and high pressure engines, with respect to the work produced?—I am quite satisfied, that taking for granted that both engines were judiciously formed, the one would take as much fuel as the other, there would be no material saving, if any; but if you associate the two principles together, as in the case of Woolf's engine, there will be a considerable saving; unite the high pressure with a condensing engine, and there is a great saving, but in their abstract characters there is none.

Mr. John Braithwaite, called in; and Examined.

Mr.
John Braithwaite.

WHAT is your profession and place of abode?—I reside in New Road, Fitzroy-square, and am an engine maker and engineer.

The Committee being desired to report upon the safety of steam boats, and upon the safety only, they will be much obliged to you to communicate what you know upon the subject?—Respecting high pressure steam, which I shall confine myself to at this moment, I will engage to make a boiler, or direct one to be made, which I will defy any engineer or other person to blow up or burst; and I have lately erected five boilers; and I am ready to prove to any gentleman, and even to any engineer, that they cannot destroy them.

Upon what principle were those boilers constructed?—Those boilers that I have fitted up, with the different apparatus for making them secure, were made of wrought iron; but I do not mean to say cast iron boilers cannot be made secure. I recommended to Mr. Martineau, for whom I erected them, that as there had been an accident in his neighbourhood, he ought to have a boiler to bear three times the pressure he meant to put upon it; and if it did bear that pressure, and they applied two safety valves with a mercurial steam gauge, properly weighted and adjusted (one of those safety valves should be at the will of the person about the boiler, and the other no man should be able to get at) it would be impossible to explode a boiler of that description. I saw the boiler after it was exploded at Wellclose-square, and also conversed with one of the men that was saved, who told me, that he had carried an additional weight to put on the safety valve just before it exploded, that the mercurial gauge

gauge there was plugged up, so that it was useless; besides which, instead of the safety valve being weighted equal to 45 pounds, they added a double weight which increased it to 90 pounds weight upon an inch, and the boiler was very improperly made. I conceive that a steam engine boiler, constructed as it ought to be constructed (I do not mean to say if you put a boiler into the hands of men not acquainted with it, without the proper safety valves, there may not be danger) but if properly constructed there is no danger.

Would you not recommend on board steam boats, wrought metal boilers to be used in preference to cast?—Certainly; I have made some discoveries myself in the boilers I have put up, which makes them perfectly safe.

Do you know any thing respecting the comparative consumption of coals in high and low pressure engines?—Not from my own actual experience, only from what gentlemen have told me where I have done business.

Mr. John Hall, called in; and Examined.

WHERE do you live?—At Dartford.

What are you by profession?—An engineer and millwright.

Have you given any attention to the construction of engines for steam boats?—I never have; I have made steam engines, but not for steam boats.

The object of this Committee being to inquire into the construction of engines for steam boats for the safety of passengers, have you any thing to communicate to the Committee on that subject?—I have only to observe, that I make them in cast iron, and I have proved them by an hydraulic press made for the purpose, and have gone as high as 250 pounds to an inch, and that I considered enough; nothing happened; and I mean the next time to try what they will bear, and I have no doubt they will bear from 700 to 1,000 pounds to an inch, for I believe they can be made now stronger than wrought iron boilers; wrought iron boilers being rivetted together, cannot be so strong as those cast in a solid mass.

May not there be some imperfection in cast iron, which may not be discoverable without an accident happening?—It is scarcely possible, if it undergoes the trial I speak of by pressure before it is put to work.

May not that trial to which it may be exposed, though no accident happens immediately from the trial, be injurious to the boiler itself?—If it is made so as to be strong enough to stand the pressure of 500 pounds upon the inch when it only wants 50, I suppose that proves it to be quite out of danger.

Are you aware that there is a difference between trial made by water pressure at a certain temperature, and the exposure of cast iron to the action of fire repeatedly, by which the metal is heated to a very high degree, and consequently expanded and then cooled again down to a temperature very far indeed below that which it was before exposed to?—I have seen the effect of that; a boiler I have made has been composed of three tubes, one a large one and two smaller ones below; those lower tubes which are exposed most to the fire have cracked generally by cooling after the engine has done working; I have known that in three or four instances; perhaps, in an hour after the engine has done working, the tubes below have cracked and the other not.

Are you not aware that the tubes which were so cracked by the application of fire, might have stood the water pressure of which you before spoke, to almost any conceivable amount?—Yes, I suppose they would.

In case of explosion, which would produce the greatest mischief, that of a cast or of a wrought iron boiler?—I suppose the greatest danger would be in the wrought iron boiler.

For what reason?—Because the cast iron uniformly cracks at the bottom underneath the large part of the boiler; the bottom tubes have cracked on the under side, so that the water went away.

Did you never hear of any instance where a cast iron boiler has exploded in another way?—I have heard of the late misfortune at Norwich, and that has been sufficiently accounted for to me, by its being made so very improperly.

Have not you heard of other instances of cast iron boilers exploding?—I believe only one.

Is not a cast iron boiler liable to be exploded in fragments?—I should think it would never happen, if it was made as cast iron boilers ought to be made; I suppose we might make a cast iron boiler that would explode, and go to pieces in that way, if it was done on purpose.

Mr.
John Braithwaite.

Mr. John Hall.

Mr. John Hall.

Have you any other suggestions to make to the Committee?—As to safety valves, they may be made as safe as can be conceived of, because they will let the steam escape when it is of an improper height, and these engines I am making will save in fuel very materially; they are on Woolf's principle; they will save two-fifths of the fuel.

Is it not easy to adjust a safety-valve to a boiler, which shall not be accessible to the engineer directing the machinery, which shall sufficiently protect the boiler from mischief?—Yes, it is quite practicable.

And so to adjust it that it will always act?—Once adjusted it will always act, and always be to be depended upon.

Then you would recommend, in any boiler, such a safety-valve to be employed?—Certainly.

Besides another under the direction of the man who works the engine?—Yes.

Mr. Alexander Tilloch, called in; and Examined.

*Mr.
Alexander Tilloch.*

WILL you state where you reside?—At Islington.

And what is your profession?—I am editor of the Philosophical Magazine, and sometimes I am called on to act as an engineer; and I am editor and proprietor of the Star newspaper.

Will you be so good, as you know the object for which we are met, with regard to the safety of persons in steam boats, to mention what suggestions you have to make to the Committee on the subject?—My opinion is, that attending to what should be attended to in every steam engine, and employing proper engineers, a steam engine would be perfectly safe, whether with high pressure or low pressure. The boilers ought always to be furnished with safety valves; and if they suspect the possibility of having a stupid man, one of the valves should be covered and out of his reach with a box over it, but perforated so that you may see when the steam operates on it. A mercurial valve is also very good; that is an inverted syphon, with a column of mercury proportioned to the purposes for which it is to be employed.

Do you apprehend much danger to arise, in case of explosion, from that mercury if it was employed?—No, because the tube is always perpendicular, and if the mercury shoots out, it goes away and falls down in rain; I am of opinion, a boiler may be made safe either of wrought or cast iron, but for great strain I would prefer cast iron, contrary to the opinion of many people, and the reason I would prefer it is the same for which it is preferred in making cannon. It is not possible to get thick plates of wrought iron perfect throughout, and you trust at last to rivets in joining them, but cast iron boilers can be made of any strength you please; instead of having a boiler that will stand sixty, it may be made to stand six hundred, of either wrought or cast iron. Another reason why I would prefer cast iron is, that the sheet iron corrodes much quicker and destroys by oxydation, so that a boiler may be safe when first set up and stand its proof, but very soon become unserviceable, or at least comparatively so. Boilers should always be cylindrical, and for an obvious reason, capacity should be got by length and number rather than by diameter. There is no more danger to be apprehended from steam as to bursting, than from the employment of condensed air, only that the water may scald; but as to the danger of the fragments being scattered about, it is the same with air as with steam, and yet all the engineers constantly employ cast iron receivers, condensers, or air vessels where pressure is wanted.

Is not cast iron liable to suffer some material injury from the contraction and expansion by heat and subsequent cooling?—Whether a boiler be made of wrought or of cast iron the metal expands and contracts, and expansion or contraction is more or less injurious in proportion as it is often repeated, but it does not prejudice a boiler made of cast more than one made of wrought iron.

Is not it more injurious to cast than wrought iron boilers?—No, I do not think it is.

In case of accident by explosion in a cast and wrought iron boiler, which, in your opinion, would be attended with the greatest mischief to the persons about it?—If an actual explosion takes place, I should think from the cast iron, but I conceive that a properly constructed cast iron boiler would be stronger, and therefore would not explode so soon. A boiler should be proved with cold water, if it is to be applied to high pressure.

Are

Are you not aware that cast iron, notwithstanding the greatest possible attention of the founder, is liable to cavities in the interior substance of the metal, which renders it uncertain when exposed to great degrees of heat?—There may be cavities in cast iron, but a boiler being proved to a strain beyond that it is to be exposed to by heat, the safety of the boiler is secured; for the temperature never can be at that point which will endanger a fracture from that circumstance.

Mr.
Alexander Tilloch.

Do you mean by that answer, to say that the rarefaction of the air in that cavity may not be so great by the heat as to occasion its bursting?—It never can, because the air that produced that cavity was at a white heat at the time the iron closed upon it, and it never can be brought to such a heat in working a boiler; my opinion is, that by a very high proof at the commencement, and attention to it, you may always have a safe boiler of cast iron.

Veneris, 16^o die Maii, 1817.

CHARLES HARVEY, Esquire, in the Chair.

Mr. George Dodd, called in; and Examined.

WHERE is your residence?—I reside at No. 8, Oxford-street.

What is your profession?—Civil engineer.

Are you a proprietor of any steam boats?—I have five under my direction.

Where are those steam boats employed?—Two between London and Richmond; one between London and Gravesend, and two between London and Margate.

How long have they, or any of them been in use?—The Thames has been in use three years.

Where does that go?—From London to Margate; the Majestic has been in use about twelve months, that goes to and from Margate; the Richmond from London to Richmond, has been in use about fifteen months, and the other two are new vessels; all these vessels lie up in the winter. The Thames has not run from London to Margate during the whole three years; she has run from London to Margate two years, and was twelve months in Scotland before I had her. I finished the Thames Margate steam yacht at Port Glasgow in Scotland, and navigated her from Scotland to Dublin, and encountered a considerable deal of bad weather, and found her most perfectly safe. No material accident happened to the engine which worked during the whole voyage; from Dublin I brought her round the Land's End, Cornwall, into the port of London.

Are all the steam boats that you now have or that you have had, used with condensing engines?—They are.

Has any accident happened during the course of their being used?—The boilers of two have been injured by the imprudence of the engine workers; but no accident of any description could or has occurred to the passengers.

What was the nature of the accidents that happened to those boilers?—The accident was the partial coming down of the boilers over the furnace mouth, being pressed down by the power of the steam, in consequence of the engine workers not sufficiently feeding the boilers, and covering the flues with water.

What are all your boilers made of?—They are made of sheet wrought iron, rivetted together.

Are they cylindrical?—They are not; they are flat sided with flat roofs, and the others have dome roofs; there is at least 1,500 rivets in the larger ones; and I consider every rivet to be in a degree a safety valve, as in all instances of bursting or tearing of this description of boilers the rivets first give way, and always give sufficient warning.

How many safety valves have you to your boilers?—One to each.

Is that safety valve accessible to the engineer directing the engine?—It is in all of them excepting the Richmond, and there it is under lock and key; the safety valve on board of the Richmond is not a lever safety valve, but they are simple weights resting on the safety valve, the whole of which is enclosed within a box and locked up, so that no discretionary power is left to the man who works the engine; I carry the key of it in general myself.

Mr.
George Dodd.

Mr.
George Dould.

Do not you think in future it would be advisable, in order for the greater safety of passengers, that boilers should be provided with two safety valves, one not accessible to the engineer directing the engine, and another accessible to him?—I think that to all boilers there should be two safety valves; the one which would be accessible to the engine worker, should be loaded with the minimum of the pressure that the chief engineer saw fit that the boiler should sustain; and that the one which would be inaccessible and locked up, should be loaded equal to the ultimatum that he would, under any circumstances, permit the boiler to support.

In a high pressure engine, what is your opinion of the weight that ought to be placed upon the safety valve of its boiler?—That in a great measure is conjectural; but for my own practice, I certainly should not allow the safety valves to be loaded with more than half the weight which I had previously tried and found the boiler was capable of supporting; all my engines are low pressure engines, and the weight upon the safety valves is regulated not to exceed six pounds upon the inch.

What is the reason that you have adopted, in your steam boats, the construction of boilers with flat sides and ends?—Because that figure gives the greatest cubical content in the smallest space, and compactness of the machinery and the boiler, is a desirable object in a steam boat.

Is it your opinion, that such boilers properly constructed, and of sufficient thickness in the plates of wrought iron, may be safely used on board steam boats having the low pressure engines?—Most decidedly so; I consider each of my boilers capable of sustaining a pressure of fifteen pounds upon the inch, but I never work them to more than six pounds upon the inch.

Are those boilers so constructed, that the water entirely covers the tube in which the fire is made?—In the Richmond, the fire is entirely surrounded by the water; it is the case also in the Majestic; but in the Thames and in the new boat to Richmond, and the new boat to Gravesend, they are what we call open furnace mouths: under the furnace mouth I place an ash hole of cast iron, bedded in clay and upon fire-bricks.

Does the water in the boilers of this latter construction, come to the upper surface of every portion of that iron, the under surface of which is exposed to the fire?—It does.

If you are acquainted with any accidents which have happened to steam engines, not under your own direction, be pleased to mention what they were and how they happened?—I recollect the boiler of the Caledonia London and Margate steam packet bursting at sea, by the forcing out of three of the rivets over the furnace mouth, which extinguished the fire, but it was not productive of any injurious consequences to any of the persons on board; and the Cork and Cove packet boat in Ireland, with 250 officers and soldiers on board, burst her boiler when lying alongside of the transport that was receiving the troops; the bursting made a fissure or opening of nine inches by eighteen inches, but the steam which escaped did no injury either to the persons on board or to the vessel, nor do I think under any circumstances of the bursting, if a wrought iron boiler at the low pressure, that is, the steam not being more than ten or fifteen pounds to the inch, that the steam which might be suddenly let loose or disengaged, would have power sufficient to raise the deck of the vessel, or to injure the parties on board.

Supposing an engine upon the high pressure principle, to have its boiler made of wrought iron, with the furnace passing through water throughout its whole length, and the boiler to be provided with safety valves properly adjusted, so as to prevent the steam being raised to more than half of that pressure which the boiler is calculated to sustain, should you then have any apprehension of ill effects arising from the use of such an engine?—Certainly, I should still consider them hazardous and liable to very fatal consequences; for all boilers deteriorate by work, by time, and by oxydation, and what might be proof at this period, at a future period the boiler might be incapable of sustaining. Besides all boilers are liable to casualties, and in case of any accident which might suddenly let loose or disengage the steam of a high pressure boiler, the steam itself would have sufficient expansive force and impetus to destroy any vessel. I have known instances, as I have stated before, of low pressure engines bursting, where they have done no injury; but I cannot conceive it possible that steam of ten or twenty times greater force could be let loose into the engine room without creating mischief.

What

What is the average price of steam boats calculated to convey passengers?—The Richmond steam yacht cost, in the first instance, including the engine, 1,800*l.* the engine itself cost about 1,000*l.*; the Majestic cost about 2,000*l.* and the engine about 2,000*l.* more; the Thames cost 2,500*l.* including the engine, at about 1,200*l.*; the new vessel that I built to go to Richmond, the hull and joiners work cost 750*l.* and an engine of fourteen horse power and apparatus, cost 1,170*l.*; the new Gravesend steam yacht, the hull only has cost 750*l.* and the engine, 1,370*l.*; but there will be various other expenses before these vessels are finished.

Can you tell what is the expense of the boiler alone?—I have just got a new boiler from Messrs. Jessop's of Butterley, for the Thames steam yacht, and I pay for the boiler 215*l.*

What additional expense do you apprehend is incurred in a boiler of these dimensions by having it of wrought iron, beyond what it would cost if made of cast metal?—Never having had any cast iron boilers, I do not feel myself competent to give a satisfactory answer.

What additional expense would be incurred by the addition of an additional safety valve?—That would depend upon the dimensions of the safety valve, but in general the additional expense would be under 4*l.*

You mean that each safety valve costs about that sum?—The most costly of them cost about that sum.

Did you ever apply a mercurial tube as a safety valve?—Never, I have to each of the boilers a mercurial barometer, that operates as an indicator of the height and pressure of the steam.

Whereabouts is the expense of that barometer?—I do not recollect, but certainly not more than 2*l.*

Did you see the Norwich steam packet which exploded?—I have been on board her, and performed a voyage with her; I went down with a view of purchasing it; I went down for that purpose twice.

What was your reason for not purchasing it?—Because it was a high pressure engine, and liable to the accident which has since occurred.

Was that your sole reason?—Yes; I went a second time with a party of German gentlemen from Bremen, who were anxious to make an immediate purchase of a steam vessel; and they also declined to purchase that or any of the boats upon the river Yare, solely because they had high pressure steam engines on board.

Did you examine the boiler which exploded when you were on board the vessel at Norwich?—I did.

What opinion did you form respecting that boiler?—I thought that it was injudiciously composed, as I found that the barrel or cylinder of the boiler was of wrought iron rivetted together; of that part I approved, but I found that one of the ends was a flat plate of cast iron, and as these two metals under the same degree of heat have different degrees of expansion, I thought it by no means a perfect and secure boiler.

Had you any opportunity of observing the boiler, so as to form a judgment whether the cast iron end was of sufficient strength to resist the pressure of the steam?—I had no such opportunity.

Had you any opportunity of observing when you were aboard, whether the steam was properly regulated?—Yes; I found that the safety valve was pressed down by a lever, and when I first went on board, the steam was so high as to require the weight near the extreme end of the lever. My opinion respecting the insecurity of high pressure engines is not formed in consequence of the late accident, for on the 3d of March last, having occasion to write to a Mr. Rawlinson, who had applied to me to construct a steam packet for his friends, I concluded my letter with these words; "Is it intended to have a low or a high pressure engine? if the latter, I should decline having any concern in the business, as they are attended with danger in any situation, but especially so in a steam packet, where the lives of all on board would be at the mercy of the sobriety and attention of the engine worker."

You mean of course to say, that they would be so if no precautions other than those which have hitherto been in use were adopted to prevent it?—Certainly; I allude to high pressure engines, as they have been hitherto usually arranged.

Mr. *Richard Wright*, called in; and Examined.

Mr.
Richard Wright.

WHERE do you live?—At No. 62, Blackfriars Road.

You are an engineer?—Yes.

Do you know the cause of the explosion of the Norwich steam boat?—I do not know it beyond this; that I know that the pressure must have been more than seventy-five pounds, having seen it worked at that pressure. My supposition is, that the man must have had it a vast deal beyond that, for there was no appearance of the boiler giving way at that time, and it was only a short time previous to the explosion itself.

Has anybody informed you, that to their knowledge the safety valve of the engine was on that day, or on any other day, improperly loaded?—No; but they were frequently in the habit of putting an additional weight on the valve; this man in particular, in both the boats which he had occasionally worked.

Do you know any thing respecting the construction of the boiler?—The boiler was eight feet long; a cylindrical boiler four feet two inches diameter; it was first made with an internal angle iron at one end, and an external angle iron at the other end. In consequence of the internal angle iron having given way, a cast iron end was substituted, which certainly was not done in a manner which I should have recommended; it might have been made safe certainly; any boiler might be made safe.

Do you attribute, in any manner, the explosion of that boiler to that particular alteration?—Not at all; the end, as altered, appears to me to have stood more than the end previous to the alteration.

What pressure was the boiler originally calculated to sustain?—Forty pounds to the inch.

Which would you, as an engineer, recommend to be used on board steam boats, wrought iron or cast iron boilers?—I think both might be used with equal safety; but that in proving them, they ought to be kept under the pressure a considerable time, say a quarter of an hour or half an hour; sudden pressure may cause flaws in a boiler, which may give rise to accident afterwards; but if under pressure a considerable time, you might see the action of it.

Mr. *John Richter*, called in; and Examined.

Mr. *John Richter.*

WHERE is your residence?—In Cornwall Place.

What are you?—A sugar refiner.

Were you acquainted with the circumstances attending the explosion of the engine at the sugar-house in Wellclose-square?—I was.

Be so good as to state them?—I had attended from time to time during the whole period of the construction of that boiler, for the purpose of boiling sugar by means of high pressure; it was necessary we should have a pressure of from six and thirty to five and forty pounds to an inch. I saw the boiler when the bottom only was put up, and I was at that time informed that they had cast the dome part of it, and that it was not sufficient, and that they were casting another. Some months afterwards I attended, and I found that other placed there. I saw them at work, and as I went in, Mr. Haigh, who was the engineer, told me they were boiling at eighteen pounds an inch; to which I replied, that must be impossible; we have never been able to boil at less than six and thirty. Upon which I went to the gauge, and I found the index of the gauge standing at five or six and thirty.

What was the nature of that gauge?—A mercurial gauge, intended as an index. I said, "Surely you are mistaken, this is six and thirty." "Oh no," he said, "that means eighteen." In consequence of which, I took an opportunity of measuring the gauge, and found the gauge to represent inches, by which I knew they were in an error. I measured to convince them of the error, but failed, and could not convince them of it till the day after the accident. In consequence of complaints from Constant, the Frenchman, in whose house it was, that it would not do its work, and his fears in pressing it on to do its work, the maker of it became anxious to shew that it would, and a day was appointed for this to be done. Constant, at three o'clock in the morning, began his work, and continued boiling till about eight, but boiling with a great deal of difficulty, because he was afraid of putting the engine to the pressure he required. He gave it up; he said he would boil no more, and the men in attendance,

attendance, who belonged to the engineer, went to fetch the engineer. He and his men came down, and persuaded Constant to have the fire lit again. He consented, after a great deal of difficulty, and went to another pan in an adjoining building, and there he was at work when the accident happened. They were urging the steam, and actually had put an immense weight upon the lever of the valve, so as to render it totally useless. This was ascertained by a Frenchman, who saw it, and who stated to the man that he was doing mischief and doing wrong. He was told to hold his tongue and mind his own business; that he knew his business, and they knew theirs; the consequence was, that immediately afterwards it blew up. After this accident, I went every day to the ruins, for the purpose of satisfying myself of what had been the cause of the bursting; and I saw the excavation until the parts of the boiler, which was of cast iron, were found; and then finding parts of this boiler in different places, the seat of the boiler being where it had been placed, but the rest scattered about in different directions, I measured the thickness of different parts of it. The bottom of it was two inches and a half thick, the upright sides of the bottom one inch and a half thick; the lower part of the dome was seven-sixteenths thick, and one of the parts at which it must have burst, and where the boiler was completely defective in the casting, was less than the eighth of an inch thick; it was not thicker than a crown piece: the wonder is that it stood at all, not that it burst. I am sure I never would have gone near it, if they had not assured me it was three inches thick in every part of it, and I was over it repeatedly. I apprehend the cause of that bad work was this; that the man was his own founder, as well as an engineer, and having made the thing in his own house, it was his interest to patch it up in the best way he could, and I understand it was actually patched.

Mr. John Richter.

Were you enabled to form any judgment to what pressure the men had raised their steam?—I could not form any judgment of that, but I understand that it had been seen at forty-eight.

What pressure was the boiler originally intended to sustain?—It was not intended to be worked above forty-five, and was ordered to be made to sustain the pressure of a hundred pounds to an inch; the whole house was blown to pieces, which, I apprehend, arose from the fragments of the boiler striking the story posts, by which the support being taken away, the walls fell inwards.

Do you know whether there was a second safety valve to this boiler?—I do not think there was.

Mr. John Steel, called in; and Examined.

WHERE do you reside?—At Dartford.

What is your profession?—An engineer.

Mr. John Steel.

Are you acquainted with the construction of steam boilers?—Perfectly so.

Will you give your opinion as to the comparative merits of wrought and cast iron?—I cannot conceive as to the safety of the two, that there is any difference whatever, when the steam is used, as it generally is, for high pressure engines to 40 pounds to the inch. If it was required to make the strongest boiler imaginable, I should consider cast iron preferable, because there you can get to an unlimited strength of resistance; wrought iron you can only have of a certain thickness.

Are you of opinion, that a boiler can be made of cast metal, free from all imperfections in the substance of the metal itself?—No; I do not imagine that it can exactly, but at the same time it can be ascertained whether it is so or not before it is used.

Do you mean to say by that, that you can by any pressure say that it is free from imperfections; or do you mean to state, that it will only sustain the pressure that it is calculated for?—When boilers are proved, they are generally proved to four or five or six or eight times the pressure intended to be put on them.

But still, though they bear that pressure, they might have those imperfections?—Certainly; but without those imperfections, they would sustain, perhaps, fifty times what is wanted.

Are you then of opinion, that the proof arising from the pressure of cold water, is sufficient to ascertain the safety of a boiler, which shall afterwards be exposed to the operation of fire or of highly heated steam?—Perfectly so;

Mr. John Steel.

because I imagine it is a great deal stronger when heated to the extent steam will heat it; cast or wrought iron is at its greatest strength when it is at 300 degrees of heat, which I believe has never been arrived at yet by steam.

Supposing the interior of the cast iron to contain cavities, by which the thickness of the external coat is very much diminished in those parts, and that those parts shall be afterwards exposed to the action of the fire, do you apprehend then, that the apparent thickness of the boiler would be any sufficient security?—No; by no means.

Have the boilers which you have been accustomed to use, been furnished with two safety valves, or one only?—Two universally.

Has either of those been locked up from the engineer?—They sometimes have and sometimes they have not; I should imagine two-thirds of them have been locked up, but I cannot exactly say; one is always exposed.

Do you think any great security is produced by the operation of a mercurial gauge, as a safety valve?—Certainly so.

Are you of opinion, that by the adoption of those precautions, high pressure steam may be used with safety, either with wrought iron or cast iron boilers?—Perfectly so.

In case by accident of the explosion of a boiler, which would be attended with the greatest mischief, a cast or wrought iron boiler?—I should imagine the explosion would be one and the same.

Would not the cast iron boiler be more liable to burst in fragments, than the wrought iron?—I have never seen it; I have seen several cast iron boilers rend, but never explode.

Would not wrought iron boilers rend?—Wrought iron boilers rend also. It appears to me it is not from the pressure, but from the heat where the water is kept from the place where the rend takes place; I never saw a cast iron boiler that had exploded.

Supposing two vessels, one of cast iron and one of wrought iron, of equal dimensions, which have no escape valves at all, to be burst by the expansive force of steam; from which of those two should you expect the greatest mischief to arise?—From the cast iron.

Mercurii, 21^o die Maii, 1817.

CHARLES HARVEY, Esq. in the Chair.

Mr. William Brunton, called in; and Examined.

*Mr.
William Brunton.*

WHAT are you, and where do you reside?—I am a civil engineer, resident at Birmingham.

You are a manufacturer of steam engines?—Yes.

Have you ever manufactured any steam engines for boats?—Yes.

Have you any thing to communicate to the Committee, for their information, respecting the best construction of the engine or boiler, to produce safety to passengers on board?—Yes; I have, during the course of my experience, made several high pressure boilers, and in turning my attention to that, I was induced to examine what had been done before me; and I think we have accomplished the object, in making a boiler, which I apprehend will become useless before it becomes dangerous.

Are you acquainted with any instances of the explosion of steam boilers?—Yes, of both kinds; I know of one which exploded at Hunslet, near Leeds, whilst I was within half a mile of it; it was a low pressure boiler; the cause was the weakness of the boiler, and the effect was, that all the windows of the neighbouring manufactory, which were of lead, were torn out, and there were a great number of the work people scalded.

Was the explosion of that boiler owing to the weakness of the metal, or improper construction?—It was, perhaps, from the weakness of the metal; I cannot answer that question exactly. It was a cast iron top; it was the upper part of the wrought iron, joining to the cast iron, that gave way. Another instance was at Shersiff-hill colliery, where the boiler was projected over the engine house; there was no other damage done, excepting breaking a capstan.

What

What sort of boiler was that?—It was a round wrought-iron boiler. Another instance was at the foundry near Stourbridge, where the boiler bursted, and one man was killed.

In all the accidents you know of, did they arise from the improper construction of the boiler, or from the ignorance or mismanagement of the engine-man?—I have no doubt that either the one or the other caused all the accidents that ever happened.

Are not common or low pressure engines often used at a higher degree of pressure, than was designed by the person who constructed the boiler?—Yes, and particularly in steam boats. I have had more than once occasion to correct that, or to remonstrate with the engine-man. I should say, that this danger is considerably increased, from a number of the boilers on board the steam packets having large flat sides.

Do not the engine-men, in many cases, increase the pressure of the steam in the boiler, although it be of no additional advantage whatever in increasing the power of the engine?—Yes, I think I may say so, if applied to the low pressure engine or condensing engine. The additional force of the steam subjects the engine to a number of inconveniences.

Have you been concerned in making boilers for high pressure engines?—Yes.

Do you think that boilers for high pressure engines can be so constructed as to become useless before they are dangerous?—Yes.

Upon what principle?—Upon the principle of having the exterior part of the boiler independent of the flue, so much so, that while the flue is injured by the current action of the fire, the exterior part of the boiler remains as to strength, unimpaired; and I conceive that a boiler thus formed, when the flue has been worn very thin, and then exposed to a greater pressure than it could sustain, the thin parts of the flue would act as so many safety-valves. From my experience in regard to these boilers, I know that when they have been worn for some time, you cannot have them tight.

You are speaking here of boilers constructed of wrought iron?—Yes; I speak of them because I have so constructed them; but I have no doubt that cast iron boilers, if constructed upon the same plan, may be made equally strong, having the outside of cast iron and the inner part of wrought iron, would do the same thing.

Do you, from your own experience, believe it possible to construct boilers which will bear an expansive force of 600 lbs. to an inch?—Yes; according to my experience I have taken a good deal of pains to ascertain the strength of wrought iron plate, and according to that I have made wrought iron boilers that would bear 600 lbs. upon an inch.

What degree of pressure have such boilers generally been worked with?—Such boilers have been worked from 40 to 50 lbs. upon an inch, and previously to being worked at all they have been tried with 150 lbs. to an inch, by water pressure.

Are you then of opinion that there is no difficulty in constructing the high pressure boiler of wrought iron, in such a manner as to make it perfectly safe?—Yes, I am of that opinion, that the boiler may be constructed of wrought iron, with perfect safety, at a pressure of 50 lbs.

After the boiler is properly constructed, do you apply any farther safeguards to it?—We adopt two safety-valves, one in an iron box under lock and key, and that is only at the control of the proprietor, and the other is open to the engine-man; and we also employ a mercurial gauge as an inverted syphon, which in the event of the steam being stronger than the mercury can sustain, the mercury will be driven out, and the boiler thereby relieve itself.

Do you consider this mercurial gauge in any other light than as an additional safety-valve, or as a contrivance by which notice is given of the pressure growing too high?—In both these respects I employ it; I consider that in both those two points of view it is useful.

Are you of opinion, that if the common safety-valves be properly adapted, the mercurial gauge may be dispensed with; when I say properly adapted, I mean sufficient in number and capacity, and one of them completely secured from the intermeddling of the engine-man?—I should think it would be safe.

What do you think respecting the comparative mischief probably to arise from the bursting of a high pressure or a low pressure boiler?—In the high pressure boiler,

Mr.
William Brunton.

boiler, the injury would be done principally by the fragments projected; in the low pressure boiler, the mischief may arise chiefly from the hot water and steam. I may mention two instances in illustration of this; the first of a low pressure boiler having giving way in the bottom, when a stream of hot water was projected against the engine-man, causing his death; the second instance was of a high pressure boiler, in which a hole was suddenly opened, the water projected itself and completely wetted a boy standing within a yard of the orifice, who was not at all injured thereby. I should say, the fragments from the cast iron boiler would be, for any thing that I know, equally destructive either with a high or with a low pressure.

What injury do you think is likely to arise from the bursting of a high pressure boiler, composed of wrought iron?—I conceive the injury would be more partial, in consequence of the fragments being larger; for I do not suppose that the wrought iron boiler would be divided into so many parts as a cast iron boiler would.

Do you apprehend, that a wrought iron boiler would burst in the same manner with a cast iron boiler; I mean, whether the manner of bursting would be the same?—Yes, I think it would.

Supposing that cast iron boiler to be burst by the expansive force of the steam, does it usually rend, or go into fragments?—Cast iron will go into fragments.

What would be the effect of the same force which would produce explosion upon a wrought iron boiler?—The probability is, that there would be much fewer fragments in the wrought iron boiler; perhaps only two.

Does not the greater tenacity of the wrought iron prevent the fragments from being carried off in the same manner as when the cast iron boiler bursts?—No; I presume, that if the wrought iron boiler bursts, whatever fragments there are, they are completely detached from that boiler, and they will go as far and do as much mischief as those of a cast iron one.

Are the fragments separated from the wrought iron boiler by explosion, in the same manner as they are from a cast iron boiler?—Yes; they would be projected with equal force, under equal circumstance. When I say that the wrought iron will rend, I am also of opinion, that a part of it may be projected: I have an immediate eye to the circumstance of one part of it being separated, and that the one part would be carried with as much violence in the cast iron as in the wrought iron.

Is there not a greater probability in the wrought iron boiler rending, and not separating into fragments?—I know that one wrought iron boiler burst with a high pressure steam; and a fragment, the largest piece, was carried to the distance of 150 yards.

Was that a piece of the wrought iron?—Yes.

Have you any thing to add to that part of your answer?—No.

You have said that the boilers which you manufacture, are generally made of wrought iron; what is your reason for preferring the wrought to the cast iron?—I was induced from the examination of several cast iron boilers, which I found cracked or broken in the lower part of them, which in my opinion arose from the unequal temperature and expansion in the exterior part of the boiler; this unequal temperature is caused by a quantity of water at all times under the flue, and consequently of lower temperature than the water above the flue; thereby causing the upper part of the boiler to expand in a greater ratio than the under part of the boiler, which in my opinion caused the fractures alluded to. This circumstance induced me to make use of wrought iron boilers, as I have explained or described, in preference to the other.

In a steam boat, what boiler would you most recommend to be used to insure safety to the persons on board; a wrought iron or a cast iron boiler?—A wrought iron boiler, properly constructed.

What safety-valves would you recommend to be placed to boilers on board steam boats, to insure the greatest safety, or to guard against the boilers exploding; I mean as to number?—I recommend at least two safety-valves; the one to be placed under the lock and key of the proprietor of the vessel, so secured as not to be accessible to the engine-man; and one which the engine-man has the usual control of.

Have you any thing to recommend with regard to the particular construction of these safety-valves, so as to insure their acting and constant operation?—

I would

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I would recommend the valve to be nearly flat or quite so, which I apprehend would be less liable to be fastened by the difference of temperature to which the valve and the seat might occasionally be subjected.

Mr.
William Brunton.

I suppose such a safety-valve would not be liable to be impeded by much friction?—As little friction as perhaps can be.

You have not any thing particularly to suggest?—No.

Mr. George Dodd, again called in; and Examined.

CAN you inform the Committee, or give them any general idea, what amount of capital is vested in steam boats?—I have been on board and am well acquainted with twenty; and know that there are more than forty in Great Britain; many have cost 5,000*l.* others 6,000*l.* and one on the Thames above 10,000*l.*; I consider a fair average to be 3,500*l.* each, making the vested capital 140,000*l.* Most of them are fitted up with peculiar elegance and accommodation, and the furniture and decorations alone form an expensive item; they are also very expensive to maintain, especially on the Thames, by reason of the great cost of coal. They are most numerous on the Clyde, where they have been productive of essential benefit to the general commerce and traffic of Glasgow, Port Glasgow, Greenock, and the neighbouring country.

Mr.
George Dodd.

What description of engines and boilers have the steam boats, you personally know, or with which you are personally acquainted?—All I know have low pressure condensing engines, and wrought sheet iron rivetted boilers, except the remaining steam boats between Yarmouth and Norwich, and one in Holland, built at Yarmouth; and they are high pressure engines.

Mr. Josias Jessop, called in; and Examined.

STATE to the Committee what you are, and where you reside?—I am a civil engineer, residing in the Adelphi, London.

Mr.
Josias Jessop.

Are you acquainted with steam boats?—I know the principle of them; I have been on board of them, and seen them.

Our object being to inquire into the method of ensuring a greater safety to the passengers on board those steam boats, have you any thing to communicate to the Committee respecting that object?—If that were the only object, there can be no doubt that one of low pressure must be more secure than one of high pressure; for although they may be both easily made secure originally, yet from the natural wear and tear, both are liable to accidents. If an accident happen to one of a high pressure, its consequences certainly will be more dangerous than that of a low pressure engine.

Is it your opinion that a high pressure boiler may be constructed so as to make it perfectly secure?—That is a theoretical question to give an answer to; I should say yes, certainly; but experience proves that both wear out.

What would be the construction, and what the precautions you should recommend, in order to insure that safety?—That it should be able to withstand the proof of two or three times the pressure to which you are likely to put it to, or rather the pressure to which you should be limited; if, for instance, you meant to work it at 50 pounds pressure, and it stand the proof of 150 pounds, the presumption is, that it is secure; but in the course of two or three years all boilers wear out.

What are the precautions that you would recommend to prevent a boiler being used at a greater power than what it was adapted for?—By having an additional safety valve, to which the person who works the engine should not have access.

Is there any other precaution that you would recommend?—I think that if it were made of malleable metal, such as iron and copper, it would be an additional security.

What is the ground of your preference to malleable or wrought metal?—It does not burst by an explosion, as brittle metal does, but tears; it would probably rend at the joints.

You do not mean then to say, that it would be impossible that a malleable boiler would burst, but that it is improbable that it would?—It would burst, but it would not fly in pieces; the rent would create a natural safety-valve.

Are you acquainted with the fact, that high pressure steam and water heated so as to raise that steam, do not scald in the same manner with water and steam at the heat of 212?—I am not acquainted with the fact; but I have no difficulty

Mr.
Josias Jessop.

in believing that the steam will not scald, although I should think that the water will.

Do you think that if the safety-valves be properly adjusted to the strength of the boiler, and so constructed as to work with perfect ease, and one of them put out of the reach of the engine-man, there is any occasion for the additional aid of a mercurial gauge?—I should think not.

Have you any particular suggestions to make respecting the construction of the boiler?—The most convenient form of the boiler is, that it should be adapted to the shape of the boat; and I should think, that that being taken for granted, the safety would depend upon the strength of the metal, and not upon the form. It should be made of such strength, that any indenture would not affect it. Although the form approaching to cylindrical is of course stronger than any other form, that which nearest approaches to a sphere is the strongest, but a cylinder with semi-circular ends is best; I mean hemispherical ends.

Is it not very possible to burst a low pressure engine, if the engine-man is careless, or rash enough wholly to neglect his steam valve?—Certainly; I think that they are equally liable to burst, only the one bursts with greater danger and risk than the other.

Mr. Alexander Nimmo, called in; and Examined.

Mr.
Alexander Nimmo.

WHAT are you?—A civil engineer, and generally residing in Dublin.

Have you any experience of the construction of steam engines for packets or passage vessels?—I have seen the steam vessels in the Clyde, on the Thames, and vessels in Ireland, and those vessels lately constructed for passage between Dublin and Holyhead; and I have studied the subject with a good deal of care, in a professional point of view. I have lately been employed by the Dublin Steam Packet Company, to alter one of their vessels, which was not found completely fitted for crossing the sea; I have altered that vessel, and she is now plying in the Bristol Channel preparatory to going to Ireland.

Have you, in consequence of your experience, any suggestions to make as to the safe construction of the engine boiler connected with such packets?—A great part of the alterations that I made upon this vessel, were intended to fit her for going through the waves, and to alter her machinery; and another portion of them was likewise directed to make her safe as to the engine. You are aware that it is necessary for all engines of that description to have safety-valves. The defects of the safety-valve which I altered, were, that it is not now in the power of the engine-man to keep it shut; it is in his power, or that of any passenger to open it, however, at all times so as to discover whether it be in good order, by a small chain and a weight being within the boiler; it is not in his power to add to it while in action: and lastly, this vessel being intended to go to sea, and to work as she has done, in very rough weather, the safety-valve is made equally effectual in every position of the ship, whether she heel, pitch or roll. The weight preserves the valve in motion, so as to keep it from sticking, and it has always the same effort to overcome. I will thus describe the nature of the valve; it is a hemispherical cup with its convex surface downwards, resting upon a collar, and to the bottom of the cup a weight is hung which has previously been adjusted; by this means the valve is always steam tight in every position, yet without danger of adhering, and must be lifted by the steam when it exceeds a given pressure; but the valve may also be lifted by a chain attached to its upper side, which is enclosed within the iron case, and may be drawn by the engine-man or any person on board, and which does not allow him to keep it down or to confine it. We have also found it necessary to prevent the accumulation of water upon the top of this valve, arising from the condensed steam when escaping; this is done by a small waste pipe descending from the bottom of the pipe which conveys away the waste steam; it is a waste pipe for water. I have thought it advisable to make the steam-valves large, and that the weight which is laid on being of itself large may admit easily of addition. I have one or two more precautions to suggest for safety: In this vessel there are two boilers communicating, and two safety-valves; there is also a mercurial gauge provided with receivers, so as to prevent the loss of the mercury in case of any sudden collapsation or disengagement of steam, also a tube of glass attached to the boiler, which exhibits the level of the water in the boiler, and precludes any idea of danger in the minds of the passengers; these boilers are made of wrought iron, but I do not consider them as being better on that account.

Do

Do you think equal mischief is likely to arise from the explosion of the wrought iron boiler, as from the explosion of the cast iron boiler?—That depends upon construction.

Mr.
Alexander Nimmo.

Put construction entirely out of the question; suppose the form exactly similar, do you conceive that equal mischief is likely to attend the explosion of the wrought iron boiler, as the cast iron boiler?—If the construction of the cast iron boiler admits of its being made of wrought iron with equal strength, then the explosion of the cast iron one would be more dangerous, as it will fly in pieces, whereas the other would probably tear; but it is scarcely fair to stop at this hypothetical case, as we must consider what can be done in practice. It is scarcely possible to form cast iron every where equally strong, and if a part be weaker than the rest, either on purpose or by accident, that will not have the safety that would be obtained by a wrought iron boiler; for instance, in cast iron boilers it is common to have holes, and if these be filled with some metal of different melting temperature from cast iron, more fusible for instance than that, the juncture will part first, and it may be made to tear as a wrought iron boiler would do; and again, the wrought iron is so much more liable to oxydation than cast iron, that although found very efficient at first, its strength and tenacity may be very speedily altered; for these reasons cast iron boilers have been preferred where high pressure engines have been used; and in small tubes the tenacity of cast iron can be made greatly to exceed that which can be given to wrought iron in the same form. I believe all large boilers have latterly been made of wrought iron, as it is difficult to make them of cast iron. Although no friend to high pressure engines in vessels, nor to cast iron boilers, on account of the danger of explosion, yet I conceive the chief danger of that kind is likely to arise from working low pressure boilers at a higher pressure than they were intended for; and I conceive that the principal improvement to be looked for hereafter in steam vessels, is, to simplify the machinery, and put it in less room, which the high pressure engine and cast iron boiler affords us the means of effecting, and the other does not. I will state another thing as of consequence, viz. as to preventing a vessel taking fire; it is advisable that the furnace and flues, if not entirely above the deck, should at least be inclosed in a case of water or other non-inflammable matter, until they arrive above the deck. This precaution I strongly recommend to be adopted.

Mr. Arthur Woolf, called in; and Examined.

WHAT are you?—I am a civil engineer in the village of Pool, in the parish of Illogan, in the county of Cornwall.

Mr.
Arthur Woolf.

Are you conversant at all with steam packets?—No; I never had any thing to do with steam packets; they are out of my line.

You have been long acquainted with steam engines?—Yes.

You invented the one that goes by your name?—Yes; I got a patent for that steam engine.

Have you any thing to communicate to this Committee, as to the object upon which we are met, which is, the safety of steam engines and boilers on board steam packets?—With the boilers, I have been in the habit of using for 14 years; we never have had any accident at all.

Of what are they constructed?—Of cast iron.

Are your boilers in general made of wrought or cast iron?—Of cast iron wholly; I approve of the cast iron boilers in preference to any mixture of metals.

Do you consider that the cast iron boiler, upon the common construction, is equally safe with a wrought iron one?—Not upon the common construction that I have seen; some I should have doubted very much; I have seen some that are rather dangerous; my patent consists of one composed of a number of tubes.

What is the difference between your construction of the boiler and the common construction, which, in your opinion, renders yours so much safer than the other?—It is always necessary in boilers to have a certain quantity of surface exposed to the action of the fire, to contain heat and steam; and if that be done in one vessel, of course it must be of considerable size greater in diameter than if composed of a number of tubes; and the risk of explosion is in proportion to its quantity of surface.

Do you mean to say that, generally?—With the same pressure, certainly.

Mr.
Arthur Woolf.

Would your boiler be as well adapted for a steam boat, as those generally made?—Yes, they are calculated for every purpose; they are generally adapted to high pressure steam; my patent was taken out for a safe boiler for a high pressure engine; indeed, in my own engines, I do not work the steam to that height as is done in what is called the high pressure engine, as the novelty of my engine is, that I work the steam twice over.

What precautions do you take to prevent accidents?—I always make my boiler to stand from 14 to 20 times the pressure that I ever make use of.

What precaution do you make use of, to prevent a greater pressure?—The safety-valve is what we depend upon; I always apply two safety-valves, as I have seen incidents where the valve has accidentally stuck fast and would not act; and I have a safety-valve, of a particular construction, that never can stick fast.

Do you use mercurial gauges?—Never for a safety-valve; I never found it necessary to have one, not for an escape.

Have you any other precautions besides those you have mentioned?—Not any, but as to trying boilers to see that they are strong enough; that is the point that I recommended in my specification, that they should be proved by pressure every time the boiler is emptied for cleansing; then to fill up the boiler with cold water quite full, and put an extra load of five or ten times the power of steam; and then, by a forcing pump, to syringe water in till it lifts the valves; then there can be no danger, there can be no explosion.

Suppose a cast iron boiler, and a wrought iron boiler of about the same form and capacity, to be exploded by the force of the internal steam, do you think that the mischief likely to be produced by each of those, would be equal; taking any form you please, and exploding both, which would do the most mischief?—I do not think the wrought iron boiler would separate into so many pieces as the cast iron boiler.

Then do you think that the explosion of the wrought iron boiler is attended with as much danger as the cast iron boiler?—In every thing, excepting what depends upon the fragments of the iron itself; I have no hesitation in saying, that cast iron boilers are safer than wrought iron boilers.

Why?—Because we can make them of a greater strength; you cannot make a wrought iron boiler so strong as a cast one.

For high pressure you may have a boiler of cast iron stronger than you can of wrought iron?—I can make it stronger and more to be depended on for great pressure; but where great pressure is not wanted, wrought iron can be made sufficiently strong to depend on.

Supposing an accident happened, would not a wrought iron boiler be attended with as great mischief as a cast iron one?—As great a number of accidents happen from the common boilers or wrought iron boilers, as from the cast ones.

Jovis, 22^o die Maii, 1817.

CHARLES HARVEY, Esq. in the Chair.

Mr. Andrew Vivian, called in; and Examined.

Mr.
Andrew Vivian.

WHAT is your profession?—Miner and engineer.

Where do you reside?—At Cambourne, in Cornwall.

Have you been long acquainted with the construction of steam engines?—For thirty years and upwards.

You are then capable of giving an opinion as to those circumstances by which danger is occasioned in the working them, and the means of preventing it?—I am.

Be pleased to state them?—The danger arises from making the steam vessel of insufficient strength for the steam; every engineer ought to be well acquainted with the power of the steam, and make the steam vessels in proportion to the strength of the steam required.

What precautions do you use to prevent explosion?—Safety-valves; not less than two on every boiler where a high pressure of steam is required, and that the boilers be made of sufficient strength, and proved before used.

To what proof are those boilers subjected, or to what proof ought they to be subjected?

Mr.
Andrew Vivian.

subjected?—By filling them with water, and loading the safety-valves with, perhaps, ten times the weight required for the engine, and then by injecting water into them, so as to lift those valves with ten times the weight required.

When you say ten times, do you mean exactly ten times?—Perhaps, ten or twelve times the weight it is intended to work.

You conceive that a boiler which has been so proved and furnished with safety-valves, properly adjusted to its contents, to be perfectly safe in working with steam, whether high or low pressure?—Yes, I do.

Is there any difficulty in so adjusting the apertures or valves; that is, in calculating of what size the valves ought to be, to produce safety in a boiler of any given magnitude?—No, no difficulty at all; it is a plain and well known thing to all engineers, or to every one who ought to pretend to be an engineer.

Is it usual to work a high pressure engine at all near to that point to which the valves are thus adjusted?—We load the engines in the mines under my directions, to about forty lbs. an inch; and the valves are then loaded to about forty-five, perhaps.

But those valves are capable of being loaded up to the full extent to which the engine has been proved?—Yes.

Is it not easy and common so to construct one of the safety-valves, of which you have spoken, as that the engine-man shall not be able to load it beyond the pressure intended?—One may be locked up, and very easily kept from the engine-man.

When that one is so locked up and kept from the engine-man, is it possible, according to the common calculation of events, that the boiler should then explode if the valve works freely?—I do not conceive it possible that it could.

Is it not easy so to construct the valve as that its operation shall not be hindered by any accident, such as adhering to the sides or clogging from fouling, or any thing of that sort?—Very easily constructed, so as not to be liable to those accidents.

Do you then see any reason why, in any situation whatever, the use of an engine should be limited to the low pressure, or that which is usually called the condensing engine?—By no means in the world.

Do you conceive that there is any difference in the liability to explode, between the boilers constructed of wrought and of cast iron?—I should conceive that cast iron could be made much stronger than wrought iron, with less difficulty; I conceive it to be a very difficult thing to make a wrought iron boiler so strong as we can have it cast; we have some of our boilers made two inches thick; and to make a wrought iron boiler equally strong as that, would be very difficult to be accomplished by workmen.

Supposing a cast iron and a wrought iron to be of the same form, and each of them to be exploded by too great an internal force being applied, which of the two do you think is likely to produce the greatest mischief in the explosion?—Certainly a cast iron boiler is likely to separate into more parts than a wrought may be, and is likely to do more mischief.

What accidents have happened to steam boilers within your own knowledge, working either with low or high pressure steam?—I have known of no accident with high pressure steam and cast iron boilers; but I have known an accident happen working with Boulton and Watt's low pressure engine, which was on the 28th of November 1811, in Wheal Abraham mine; a wrought iron boiler working with low pressure steam exploded there and scalded six men, three of whom died in the course of a week afterwards.

Were any persons at that time killed by the fragments of the iron?—No; it was entirely by the steam and the water.

Do you recollect any instance in which a wrought iron boiler exploded, so as that any persons were killed by the fragments?—I do not.

Do you at all know, whether there is any difference between the power of the steam or water to scald, when under high or low pressure?—The steam from low pressure scalds much worse than the steam from high pressure; as to the water I cannot say. I cannot conceive that water can issue to any great distance from a high pressure boiler, it must soon be steam; it must be converted into steam from its heat; water cannot go beyond 212 degrees of heat, unless it is confined; beyond that it must be steam.

Mr.
Andrew Vivian.

Have you ever known any persons scalded by the steam or the water issuing from a high pressure boiler?—No.

Have you ever known any instances of persons being scalded by the steam or water from a low pressure one, besides that which you have mentioned?—I have heard of a great number of instances of this in different mines, but only that one came directly under my own eye.

You have given the Committee to understand, that when boilers made of wrought iron are exposed to steam of high pressure there is great difficulty in making them sufficiently strong, for that the rivets are apt to draw, and the joints to become loose; do you not conceive it very possible for the boilers in such cases to become useless by permitting the steam to escape, and yet not to explode so as to produce any fatal accident whatever?—I am quite of opinion, that boilers made of wrought iron for high pressure engines will soon become leaky, and may not explode. I have known of an instance of a boiler of that description made for Herland mine, and it soon became leaky and unfit for use in a very short time; the consequence of which is, the mine is knocked up, and a great number of people out of employ.

But no accident happened in consequence of this, by which any person was injured?—No.

Supposing the only object to be safety to the lives or limbs of the persons who should be surrounding the engine, would you in that case prefer having the boiler of a high pressure engine of wrought or of cast iron?—I would have cast iron, because it can certainly be made stronger than wrought iron for the same expense.

Do you take into that calculation the difference of the mischief which might be occasioned, supposing the boiler by any accident to explode?—I consider that risk is so small as that it scarcely need be taken into the question, because all explosions may be easily prevented by proving the boiler every time it is cleansed, which I think should be at least every month.

Is the operation of proving the boiler so easy as that it may be performed on board a steam boat every month without expense or inconvenience?—Certainly it consists, as I have said before, only in filling the boiler with cold water, putting great additional weight upon the safety-valves, and then injecting water by a forcing pump till the valve is lifted with the additional weight.

Is it then your opinion, that every steam engine ought to be provided with those means of proving the boiler, and that they ought to be applied as often as you have mentioned?—Yes, they should; the very pump by which the boiler is supplied with water may be used conveniently and sufficiently for this purpose; high pressure boilers are all fed in the common way by forcing pumps, and there is no difficulty in applying it to the low pressure boilers.

Have you found the use of a high pressure engine of any advantage to the Cornish mines?—Of very great advantage, which can be proved by looking at the monthly reports, which I am fully convinced are correct.

Do you conceive that a low pressure engine can be reckoned entirely safe, unless furnished with the safety-valves, such as before described, and to one of which at least the engine-man has no access?—I conceive that every engine ought to have those valves, and one should be locked up to prevent careless engine-men doing mischief, which low pressure engines are as liable to as high.

Have you any means of estimating the comparative consumption of coals by either high or low pressure engines?—Yes.

Be so good as to state your opinion upon that point?—I conceive that a high pressure engine does greater duty with the same coals than a low, which will also be proved by the monthly reports.

Have you any further information on this subject, which you wish to communicate to the Committee?—Being desired to attend here on the part of the proprietors of three of the largest mines in Cornwall, the united mines of Crowan, Dolcoath and Weal unity, I wish to state their hope, that the Legislature will not interfere to prevent the use of high pressure engines, either on board boats or in any other way.

You have not been used to steam engines on board boats, but in mines chiefly?—Chiefly in mines. I have seen them on board boats.

Do your answers apply equally to steam engines on board boats as in mines, or may not more caution be necessary in boats than in mines?—I conceive the answers to be applicable to boats as well as to mines.

Mr. *Thomas Lean*, called in; and Examined.

WILL you state your profession, and place of abode?—I reside at Crowan in Cornwall, and I am employed by nearly the whole of the miners in Cornwall to inspect their engines, and make monthly reports of the work they perform.

Mr.
Thomas Lean.

You are then well acquainted with steam engines of every various construction?—Certainly I am; I see fifty-seven every month.

Do you conceive that there is any material difference in the respective safety of those engines?—Some of the engines are certainly safer than others.

Be so good as to state which, and why?—I conceive there is no danger whatever in the use of high pressure steam engines; and for this reason, that in general, for an engine that is intended to be worked with high steam, the materials are made stronger in proportion than the materials used for steam of low pressure.

What are the precautions which you think it necessary to take, in order to render a high steam engine perfectly safe from accident?—The materials should be made strong enough, and there is no difficulty in doing that; and there is a good deal depending on the construction of the safety-valve, which should be so constructed as to go quite easy and without any possibility of sticking.

Do you not think it of importance, if not necessary, that a boiler should have two safety-valves?—Certainly; and every high pressure steam engine that I attend to has two safety-valves.

Do not you confine one of those from the engine-man?—Not in any instance.

Should you or not think it necessary, on board a boat for passengers worked by a steam engine, that there should be an additional safety-valve to the boilers which the engine-man could not come at to prevent its operation?—That would certainly be very desirable, and I should think necessary.

Have you any choice, in point of safety only, between a boiler constructed of cast iron or of wrought iron?—Were I to have a boiler where I wished to have the greatest strength, I would certainly have it made of cast iron; I have not one doubt that a cast iron boiler can be made much stronger than it is possible to make a wrought iron one; in fact, the explosions that we have had in Cornwall have all been in wrought iron boilers, but I never had one in cast iron boilers, nor have we had an accident from high pressure steam; all the accidents have been from low pressure steam in Cornwall.

To what do you attribute that?—I attribute that to the boilers not having their proportionate strength to the weight they ought to bear, that the high pressure steam engines have.

Of what nature are those failures which usually happen in the wrought iron boilers?—The one which I witnessed the explosion of, threw off the man-hole door.

Do you mean that the bolts by which the man-hole door was secured, gave way?—Yes.

Are there not man-holes to cast iron boilers?—There are.

Then might not the best constructed and the strongest cast iron boilers have been equally liable to the accident you have been mentioning, from the mere failure of the bolts, by which the man-hole door was secured?—Certainly not, and for this reason, the man-hole door to a cast iron boiler is contrived to be on the inside; it does not depend upon bolts at all as they are constructed with us, it bears against the side of the boiler.

Would it not be equally easy to affix man-holes so constructed to wrought iron boilers?—There is no difficulty in doing it, either one way or the other.

Supposing a cast iron boiler and a wrought iron boiler to be exploded by having too great a pressure applied, from which of the explosions should you apprehend the greatest danger?—I think the danger is equal from one as the other.

In what manner do you apprehend then, that a cast iron boiler would explode?—Probably there might be some parts of the cast iron boiler separate, and the wrought iron boiler would probably rend.

Should you not then apprehend a greater danger from the explosion of a boiler which burst into fragments, than from one which only rent?—In every boiler that is built, there is one part of it weaker than another, and it is hardly possible for a boiler to be thrown about in fragments to do mischief. I should not feel any hesitation to sit on the cast iron boilers I have seen in Cornwall when an explosion

Mr.
Thomas Lean.

explosion took place; I am convinced the explosion would take place at the under part.

Do you think it necessary or advantageous that those boilers should be proved at their first erection, and that that proof should afterwards be repeated at intervals?—It is certainly desirable it should be done at the first erection; they ought always to be proved; the cast iron boilers which have come under my notice in Cornwall, I calculate to be sufficient to resist at least thirteen times the pressure of steam we have ever used in them.

To what heat are those boilers usually proved?—We work in general forty lbs. to an inch in the high pressure boilers, and we prove them sometimes as high as three hundred.

By a proof of this nature, so much within the supposed capacity of resistance of a boiler, you do not apprehend that any risk is incurred of injuring it?—Certainly not.

And you yet conceive, that the proof is so far beyond the ordinary resistance which is required from the boiler, as that there is no danger whatever of its bursting with a pressure of forty or fifty lbs. an inch, when it has been proved by a pressure of three hundred?—Certainly not.

Do you apprehend, that it is perfectly easy so to construct and to secure your safety-valves, as that no engine-man, however careless, shall be able to raise the steam beyond the pressure of forty or fifty lbs. per inch?—There certainly is not the least difficulty in it.

You apprehend then, that with a boiler so constructed, so proved, and so guarded against carelessness, there would be no danger whatever in any situation?—Certainly not; neither in a steam boat or an engine employed in a manufactory or mines, or in any manner whatever.

As to the economy in the use of coals, what is your opinion?—My opinion is, that the high pressure engines in Cornwall have saved at least two-fifths of the whole consumption of coals in the county; in some instances it has saved three-fifths.

What means have you of ascertaining that fact?—In the pursuance of my ordinary employment, I attend to the various engines in Cornwall, and compute their duty; the quantity of coals that is consumed by the engines is rendered to me on oath; it is the same that is sworn to at the custom house. The ascertaining the weights which the engine lifts is carefully and correctly measured; and from this I calculate the work performed by the engines, of which I make a monthly report, and find, that those engines which work with a high pressure steam are more economical in their operations than those of the low pressure, so much so, that were the low pressure steam engines to be introduced into the mines of Cornwall, it would stop upwards of two thirds of them.

Is the paper which you have, one of those accounts?—It is the account for the last month.

[It was delivered in, and read;—and is printed in the next and following pages.]

And this account you declare, upon your own knowledge, to be accurate as to the particulars it contains?—I do.

Do you consider it as important to the safety of an engine, that the boiler should be frequently cleansed?—If a boiler is foul, if there is a quantity of mud in it, it may prevent the water from coming in contact with the iron, and in that case the boiler is liable to injury; I have known a wrought iron boiler to burst from that very cause; I never knew a cast iron boiler to explode in any instance.

Is there any difficulty in subjecting the boiler to the usual proof, every time it is cleansed?—There is no difficulty whatever, any other than having the apparatus prepared for it, which is very easily done.

Is that apparatus either expensive, or difficult of construction, or of application?—No.

Can it be applied with ease by any engine-man or engine proprietor, who is at all acquainted with the construction or working of a steam engine?—Yes; and the management of it is so plain that no person can misunderstand it, if they are unacquainted with all the other parts of the engine.

In what does this proof consist, and how is it performed?—The proof consists of first filling the boiler with water, and then loading the safety-valve to any point required; then injecting water by a forcing pump, till the safety-valve, with the additional weight upon it, is raised.

Have

Have you any other suggestions to make on the subject of the safety of steam engines, besides what you have already said?—I think not.

Mr. Thomas Lean.

Mr. George Dodd, again called in; and Examined.

FOR what purpose do you attend?—To produce a new safety-valve.

Mr. George Dodd.

What are the advantages attendant on the safety-valve which you have to offer to the Committee?—I propose to the Committee the valve I now offer as a second valve, as it admits of being locked up so as to be inaccessible to the engine worker; it prevents the possibility of his obstructing its action, either by going into the boiler when the boiler is cool, or under any circumstances whatever.

[The Witness produced it.]

Is there any provision against the valve adhering in any part, so as to prevent its operation?—There is; the safety-valve has not a conical bottom as is usual in most safety-valves, but has a flat bottom resting upon a flat circular ring, the steam escapes from the sides of the box through apertures, so constructed as that nothing can be introduced to impede its action.

William Lester, Esq. called in; and Examined.

WHAT is your place of abode and profession?—I am an engineer, residing at No. 3, Mount-street, Lambeth.

William Lester, Esq.

For what purpose do you attend?—To exhibit the plan of a safety-valve, in consequence of my having presented a petition to the House of Commons, which was referred to this Honourable Committee.

Be pleased to produce your plan?—The valve of which I here deliver in the drawing, is so constructed, as to prevent the possibility of any person having access to it to prevent its action; it is self-acting entirely from the gravity of a column of water acting upon the valve, which prevents its being locked by any mode, and it cannot adhere because it is not a cone acting in another cone, but a flat surface pressing upon the top of a cylinder; and being inclosed in a box and the steam getting out at the bottom, there is no matter can get upon the valve to cause its adhesion.

Paper delivered in
by Mr. Thomas Lean, }

WORK DONE BY THE FOLLOWING - - -

M I N E S.	ENGINE.	Load per Square Inch in Cylinder.	Length of Stroke in Cylinder.	No. of Lifts.	Depth in Fathoms.	Diameter of Pump in Inches.	Time.
1.—DOLCOATH.	Great Engine 76 Single.	lb. 11 2	ft. in. 9 0	1 2 7 2	fm. ft. 2 0 38 0 141 1 23 0	in. 8 12 $\frac{1}{8}$ 12 13	March 25th to April 30th.
2.—DITTO.	Stray Park 63 Single.	8 4	7 9	1 1 3 1 1 1 1	1 2 6 0 60 5 21 0 22 0 18 0 6 0	16 $\frac{1}{2}$ 11 $\frac{3}{8}$ 11 $\frac{1}{4}$ 11 $\frac{1}{8}$ 9 6	Ditto.
3.—COOK'S KITCHEN.	36 Double working Single.	9 9	7 0	2 3 2 1	34 5 46 2 20 4 4 3	10 9 $\frac{1}{2}$ 9 $\frac{1}{4}$ 6	Ditto.
4.—TINCROFT.	48 Single.	8 0	8 2	1 4 1 1 1 1	1 0 75 1 18 2 2 0 3 0 10 3	8 10 8 $\frac{1}{4}$ 5 6 8 $\frac{1}{2}$	Ditto.
5.—WH. FANNY.	58 Double.	16 5	7 6	1 3 1 1 1 1	21 0 63 0 7 3 3 0 15 0 3 5	14 $\frac{3}{4}$ 14 $\frac{1}{2}$ 16 6 14 $\frac{1}{2}$ 14 $\frac{1}{2}$	Ditto.
6.—WH. VOR.	Old Engine 48 Double.	14 0	7 0	3 1 1	60 0 26 0 9 0	13 13 $\frac{1}{4}$ 10	March 28th to May 5th.
7.—DITTO.	Woolf's Engine 53 Single Gt. Cylin.	15 4	9 0	1 1 2 1 1 1	1 3 25 3 59 0 20 2 9 2 8 4	10 12 $\frac{1}{2}$ 13 14 12 $\frac{1}{4}$ 8	Ditto.
8.—VEL VREAH.	45 Double working Single.	7 4	6 9	1 1 1 1 1	25 3 26 0 10 0 12 3 8 0	9 11 10 6 $\frac{1}{2}$ 9	Ditto.
9.—WH. BREAGE.	30 Double.	20 6	5 9	5 1 2 3 1	2 0 31 4 43 2 42 0 13 0	7 6 8 $\frac{1}{4}$ 7 $\frac{1}{2}$ 7 $\frac{1}{2}$	
10.—CRENVER.	70 Single.	9 5	8 6	4 1 1	80 0 2 0 13 3	15 12 7	March 29th to April 26th.

SELECT COMMITTEE ON STEAM BOATS, &c.

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- - - ENGINES IN APRIL 1817.

Consumption of Coal in Bushels.	Number of Strokes.	Length of Stroke in Pump.	Load in Pounds.	Pounds lifted One Foot high by a Bushel of Coal.	Strokes per Minute.	REMARKS AND ENGINEERS.
3,324	310,690	ft. in. 7 6	61,197	42,900,035	6. 0.	Drawing perpendicular 138 fathoms on the underlay, 24 fathoms bob over the cylinder, and four balance bobs in the shaft, and 40 fathoms of dry rods. <i>R. Jeffery & J. Gribbel.</i>
1,504	245,010	6 0	32,264	31,535,914	4. 7.	Drawing perpendicular 110 fathoms underlay, 24 fathoms with bob over the cylinder, and two balance bobs underground and one at the surface. <i>R. Jeffery & J. Gribbel.</i>
1,446	354,160	3 6	19,625	16,823,212	6. 8.	Drawing all the load with flat rods 40 fathoms perpendicular, 57 fathoms on the underlay. <i>James Pearce.</i>
2,160	377,240	6 6	20,150	22,874,541	7. 3.	Bob over the cylinder, drawing perpendicular 84 fathoms, and 42 fathoms in the underlay. <i>A. Woolf.</i>
4,262	355,870	7 6	44,500	27,867,717	6. 9.	Drawing perpendicular with the cylinder over the shaft, and bob under the cylinder. <i>James Mayne.</i>
2,416	276,290	5 6	32,225	20,268,604	5. 0.	Drawing perpendicular with bob over the cylinder, and 42 fathoms flat rods. <i>A. Woolf.</i>
2,860	405,400	7 6	40,884	43,468,554	7. 4.	Drawing perpendicular with bob over the cylinder, and one balance bob. <i>A. Woolf.</i>
1,408	364,500	5 3	15,110	20,536,131	6. 6.	Drawing one-third of the load with flat rods, and bob under the cylinder. <i>A. Woolf.</i>
		5 9	14,882			Drawing perpendicular 40 fathoms, on underlay 85 fathoms, cylinder over the shaft, and bob under the cylinder, and balance bob underground.
3,636	313,170	7 6	38,759	25,037,725	7. 75.	Drawing perpendicular with bob over the cylinder, and one balance bob, and 200 fathoms of flat rods at the surface. <i>A. Woolf.</i>

(continued.)

WORK DONE BY THE FOLLOWING - - -

MINES.	ENGINE.	Load per Square Inch in Cylinder.	Length of Stroke in Cylinder.	No of Lifts.	Depth in Fathoms.	Diameter of Pump in Inches.	Time.
11.—OATFIELD.	New Engine 70 Single.	lb. 9 9	ft. in. 8 3	2 1 1 1 1	fm. ft. 44 5 21 3 25 3 22 0 10 0	in. 14 13 12 11 8	March 29th to April 26th.
12. WH. ABRAHAM.	Old Engine 63 Single.	10 0	8 3	1 1 1 1 1 2 1 2	6 0 4 0 22 3 35 0 21 0 23 0 12 0 63 0	7 7 $\frac{3}{4}$ 13 12 $\frac{1}{2}$ 11 $\frac{3}{4}$ 8 6 7	Ditto.
13.—DITTO.	Woolf's Engine 45 Single Gt. Cylind.	15 1	7 0	1 2 1 1 1 1	12 3 65 0 12 0 11 0 10 0 4 0	6 12 8 7 7 6	Ditto.
14.—DITTO.	Woolf's Engine 60 Single Gt. Cylind.	3 81	9 0 	1 1 1 1	21 0 23 4 3 3 12 0	12 11 7 9	April 9th to April 26th
15.—WEST WH. FORTUNE.	Old Engine 48 Single.			1 4	9 0 83 0	9 10	
16.—DITTO.	New Engine Double.			1 3 1 3 1	8 0 69 3 18 0 30 0 8 0	9 12 11 10 $\frac{1}{2}$ 8 $\frac{1}{2}$	Ditto.
17.—WH. CLOWANCE.	53 Double working Single.		7 0	1 1 1 1 1 1	11 0 21 5 23 0 10 0 16 0 6 0	7 12 11 $\frac{3}{8}$ 10 10 $\frac{1}{4}$ 8 $\frac{1}{2}$	March 29th to April 18th.
18.—BLUE HILLS.	58 Single.	5 9	7 9	1 2 1 2	3 0 32 4 22 0 20 0	16 $\frac{1}{4}$ 13 12 7	March 26th to April 29th.
19.—UNITED MINE.	Sims 63 Double.	17 7	9 0	1 1 5 1	2 0 22 0 114 0 9 1	12 12 $\frac{1}{2}$ 16 14	April 1st to April 30th.
20.—DITTO.	Stoddart's formerly Ale and Cakes. 63 Double.	19 2	9 10	1 7 1	6 0 130 0 4 0	10 $\frac{1}{2}$ 16 12	Ditto.

 This Lift worked half of the Time.

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- - - ENGINES IN APRIL 1817.

Consumption of Coal in Bushels.	Number of Strokes.	Length of Stroke in Pump.	Load in Pounds.	Pounds lifted One Foot high by a Bushel of Coal.	Strokes per Minute.	REMARKS AND ENGINEERS.
3,582	291,420	ft. in. 7 3	43,393	25,594,783	7. 2.	Drawing perpendicular with bob over the cylinder, and one balance bob at surface, and two underground, and 110 fathoms dry rods. <i>A. Woolf.</i>
2,484	363,650	7 3	35,533	37,713,938	9. 0.	Drawing perpendicular with bob over the cylinder and two balance bobs. <i>A. Woolf.</i>
1,404	368,300	7 0	24,042	44,147,208	9. 1.	Drawing perpendicular with bob over the cylinder, and two balance bobs, and 70 fathoms of dry rods. <i>A. Woolf.</i>
650	162,150	7 6 6 0	12,393 1,988	24,674,490	6. 6.	Drawing perpendicular with bob over the cylinder, and one balance bob; and 80 fathoms horizontal rods. <i>A. Woolf.</i>
		7 0	18,467			Drawing perpendicular with bob under the cylinder. <i>Thomas Bratt.</i>
		7 0	34,197			Drawing perpendicular with bob under the cylinder. <i>Thomas Bratt.</i>
1,700	183,940	7 0	19,948	15,108,615	6. 35.	Drawing with bob under the cylinder 24 fathoms perpendicular, 54 fathoms underlay with 16 fathoms dry rods, and 12 fathoms flat rods underground.
1,530	246,520	5 9	21,395	19,821,698	5. 0.	All the load drawn with flat rods bob over the cylinder. <i>Joseph Rickard.</i>
6,080	262,810	7 0	70,988	21,479,357	6. 3.	Drawing perpendicular with bob over the cylinder, with two sets of rods connected by a diagonal rod, and two balance bobs underground, and 40 fathoms of flat rods underground. <i>William Sims.</i>
7,353	338,200	7 9	70,601	25,166,428	8. 1.	Drawing perpendicular with bob over the cylinder and two balance bobs underground, and 20 fathoms of flat rods underground. <i>William Sims.</i>

WORK DONE BY THE FOLLOWING - - -

MINES.	ENGINE.	Load per Square Inch in Cylinder.	Length of Stroke in Cylinder.	No. of Lifts.	Depth in Fathoms.	Diameter of Pump in Inches.	Time.
21.—UNITED MINE.	William's Engine 65 Double.	lb. 16 6	ft. in. 8 9	1 1 1 5 1 1 1	fm. ft. 5 0 7 0 24 0 104 0 21 0 12 0	in. 10 7 9 $\frac{1}{2}$ 15 14 $\frac{1}{2}$ 15	April 15th to April 30th.
22.—DITTO.	Poldorey 63 Double.	13 5	9 10	6 1 1 1 1	95 0 7 0 2 2 5 0	16 12 12 10	April 1st to April 30th.
23.—WH. FRIENDSHIP.	40 Double.	8 8	8 0	1 1 1 2 1 1 1	19 4 26 5 26 0 33 3 8 3 8 3	6 $\frac{1}{2}$ 13 13 10 8 9	March 27th to May 3d.
24.—DITTO.	New Engine 56 Inch Double.	10 9	7 3	1 1 1 1 1 1 1 1 1	19 0 30 0 10 4 10 4 10 0 10 0 31 2 13 2	8 $\frac{1}{2}$ 15 13 8 16 10 12 7	Ditto.
25.—WH. NEPTUNE.	52 Double.	8 4	7 10	1 2 1 1 1 1	25 3 44 0 11 3 12 0 10 0	8 13 11 8 6	Ditto.
26.—TRESKIRBY.	Cock's Engine 50 Double.	14 25	7 7	3 1 1	64 0 8 0 5 0	16 13 6	March 31st to May 1st
27.—WH. DAMSEL.	42 Double.	16 7	7 6	1 1 3 1 1 1 1 1	19 3 20 4 61 0 10 4 10 3 9 0 9 1	11 $\frac{1}{4}$ 11 10 $\frac{7}{8}$ 10 $\frac{1}{2}$ 10 8 7	April 1st to April 30th.
28.—CHACEWATER.	66 Double.	18 6	10 0	1 1 2 3	2 3 10 1 35 5 46 5	16 14 19 19 $\frac{1}{2}$	March 31st to May 1st.
29.—WH. BASSET.	24 Double.	16 2	7 6	1 1 1 1	27 0 19 0 20 3 10 3	6 10 9 8 $\frac{1}{2}$	March 26th to April 29th.

ENGINES IN APRIL 1817.

Consumption of Coal in Bushels.	Number of Strokes.	Length of Stroke in Pump.	Load in Pounds.	Pounds lifted One Foot high by a Bushel of Coal.	Strokes per Minute.	REMARKS AND ENGINEERS.
2,064	167,120	6 9	71,805	39,244,354	7. 7.	Drawing perpendicular with bob over the cylinder, and balance bobs. <i>William Sims.</i>
6,400	313,440	7 9	53,514 55,050	20,311,573	7. 48.	Drawing perpendicular with bob over the cylinder, with two sets of rods connected by cross and counter bobs. <i>William Sims.</i>
1,890	218,840	8 0 3 9	19,962 9,372	22,560,319	4. 1.	Drawing perpendicular with bob under the cylinder, and 50 fathoms of flat rods at surface. <i>Thomas Bratt.</i>
5,346	477,490	3 6 4 6	9,228 1,336	26,790,909	8. 9.	Drawing perpendicular with the bob under the cylinder, and part of the load with flat rods 56 fathoms in length. <i>Thomas Bratt.</i>
2,468	332,800	6 0 5 6	21,412 2,307	19,032,376	6. 3.	Drawing perpendicular with bob under the cylinder, with 80 fathoms flat rods, and 60 fathoms dry rods.
3,726	378,680	5 9	36,646	21,415,289	8. 5.	Drawing perpendicular with bob under the cylinder, with two sets of rods connected by a counter bob, and 120 fathoms dry rods. <i>William Sims.</i>
1,658	181,700	5 9	31,565	19,890,423	4. 34.	Drawing perpendicular with bob under the cylinder, with two sets of rods connected by a counter bob, and 110 fathoms of dry rods. <i>William Sims.</i>
8,096	315,100	8 6	72,928	24,126,322	7. 0.	Drawing perpendicular with bob over the cylinder, with two sets, connected by cross and counter bobs. <i>Samuel Moyle.</i>
1,480	360,050	5 6	10,029	13,412,214	7. 4.	Drawing perpendicular with bob under the cylinder. <i>William Sims.</i>

(continued.)

WORK DONE BY THE FOLLOWING - - -

M I N E S.	ENGINE.	Load per Square Inch in Cylinder.	Length of Stroke in Cylinder.	No. of Lifts.	Depth in Fathoms.	Diameter of Pump in Inches.	Time.
		lb.	ft. in.		fm. ft.	in.	
30.—WH. CHANCE.	Sims' Engine 45 Single Gt. Cyl.	13 0	7 11	1 3 2 1	38 3 62 5 47 2 2 0	7 12 6 7 $\frac{1}{2}$	March 31st to May 1st.
31.—WHL. UNITY.	Wood Engine 52 Single.	6 6	6 8	1 1 3 1 1	13 0 26 3 36 3 21 5 0 4	6 8 9 $\frac{1}{4}$ 10 $\frac{1}{2}$ 15	March 31st to April 30th.
32.—DITTO.	West Engine 58 Double.	13 0	7 5	2 3 1 3 1 1 1	35 4 56 2 20 0 43 4 9 3 2 0 2 4	14 13 10 $\frac{1}{2}$ 8 5 $\frac{1}{2}$ 6 12	Ditto.
33.—DITTO.	Tadpole (Woolf's) Engine Gt. Cyl. 60in. Single.	13 1	10 0	6 1 1	112 0 4 0 11 0	16 10 12	Ditto.
34.—* POLDICE.	Bissa Pool Engine 64 $\frac{1}{2}$ Double.	11 6	7 9	3 3 1	47 0 47 0 4 0	17 $\frac{1}{4}$ 12 12	Ditto.
35.—TING-TANG.	20-Inch Double.	21 9	4 6	1 4 1	2 0 40 5 28 3	5 $\frac{1}{4}$ 9 4 $\frac{1}{2}$	April 1st to April 30th.

* The Counter of this Engine has been idle.

SELECT COMMITTEE ON STEAM BOATS, &c.

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- - - ENGINES IN APRIL 1817.

Consumption of Coal in Bushels.	Number of Strokes.	Length of Stroke in Pump.	Load in Pounds.	Pounds lifted One Foot high by a Bushel of Coal.	Strokes per Minute.	REMARKS AND ENGINEERS.
936	251,910	ft. in. 6 0	25,888	41,804,141	5. 64.	Drawing about one quarter of the load with flat rods, bob under the cylinder, the whole drawn perpendicular. <i>William Sims.</i>
1,088	237,950	5 9	16,044	20,176,104	5. 5.	Drawing (the load in four shafts) perpendicularly with main bob over the cylinder, and nine bobs connected to three sets of flat rods, which are 406 fathoms in length, and about 26 tons in weight, and 189 fathoms of dry rods in the several shafts. <i>Richard Michell.</i>
2,304	148,900	5 6	46,033	16,362,293	3. 43.	Drawing perpendicularly 160 fathoms on the diagonal, 10 fathoms with main bob over the cylinder, and two balance bobs underground, and 70 fathoms of flat rods. <i>A. Woolf.</i>
2,960	257,240	6 3	62,703	34,057,685	5. 9.	Drawing perpendicularly with main bob under the cylinder, and two balance bobs under ground. <i>A. Woolf.</i>
		6 9				Drawing perpendicularly with main bob under the cylinder, and two sets of rods connected by counter bobs, and one balance bob. <i>A. Woolf.</i>
952	445,040	4 6	7,467	15,707,995	10. 65.	Drawing perpendicularly 39 fathoms on the underlay, 24 fathoms main bob over the cylinder, and one balance bob at the surface. <i>William Sims.</i>

MINUTES OF EVIDENCE TAKEN BEFORE THE

Work done by the following ENGINES, in drawing the Stuff out of the Mines, in March 1817.

MINES.	ENGINE.	Length of Stroke in Cylinder.	Coal in Bushels.	Depth drawn in Feet.	Number of Kibbals.	Pounds Weight in a Kibbal.	Pounds drawn 1 Foot high by a Bushel of Coal.	Common Whim Kibbals, drawn from 100 fathom deep, by a Bushel of Coal.	ENGINEERS.
1.—DOLCOATH.	Stray Park, 14 Double.	ft. in. 7 6	242	1,020	1,663	430	3,014,015	13 9	R. Jeffery and J. Gribbel.
2.—DITTO.	Whl. Briant 16 Double.	4 0	338	1,038	3,302	390	3,954,780	14 6	R. Jeffery and J. Gribbel.
3.—DITTO.	Whl. Briant New Whim.		371	1,080	3,848	410	4,592,707	22 7	R. Jeffery and J. Gribbel.
4.—DITTO.	Teague, 24 Double.	7 0	368	1,326	3,905	480	6,753,952	33 5	R. Jeffery and J. Gribbel.
5.—DITTO.	Middle, 20 Double.		444	1,380	3,375	340	3,566,554	17 6	R. Jeffery and J. Gribbel.
6.—DITTO.	East 10 Double.	7 9	504	1,050	3,817	410	3,260,360	16 1	R. Jeffery and J. Gribbel.
7.—DITTO.	Valley Engine.		265	894	3,489	712	8,380,551	41 5	R. Jeffery and J. Gribbel.
8.—OAT FIELD.	Old Sump, 21 Single.	5 0	257	1,122	1,931	390	3,287,809	16 3	A. Woolf.
9.—DITTO.	New Sump, 15 Single.	4 0	253	1,332	1,508	400	3,175,740	15 7	A. Woolf.
10.—WHEAL FORTUNE.	Woolf's Engine.		54	564	1,064	504	5,600,896	27 7	Thomas Bratt.
11.—WHEAL VOR.	Woolf's Engine.		140	696	1,160	490	2,825,760	14 0	A. Woolf.
12.—DITTO.	New Engine.		324	696	3,378	660	4,789 253	23 7	A. Woolf.
13.—WHL. ABRAHAM.	Woolf's Engine, East Shaft.		396	1,200	3,938	450	5,370,000	26 6	A. Woolf.
14.—DITTO.	Puffer 16 & half double Mid. Shaft.	8 0	452	1,140	2,691	450	3,054,165	15 1	A. Woolf.
15.—DITTO.	Woolf's Engine, Blewett's Shaft.		242	960	3,736	490	7,262,042	36 0	A. Woolf.
16.—COOK'S KITCHEN.	Chaple's 15 Double.	5 0	410	1,068	3,611	420	3,913,049	19 6	James Pearce.
17.—DITTO.	New Whim, 15 Double.	5 0		798		300			James Pearce.
18.—WHEAL DAMSEL.	Fox's Engine.		300	948	3,472	480	5,266,329	26 1	William Sims.
19.—WHEAL BREAGE.			182	744	2,130	350	3,047,538	15 1	
20.—TRESKIRBY.	Sims' Engine.		216	720	3,608	430	5,171,466	25 6	William Sims.

Work performed by the following ROTATIVE ENGINES, Stamping Ores at the Mines, in April 1817.

MINE.	ENGINE.	Length of Stroke in Cylinder.	Number of Heads.	TIME.	Consumption of Coal in Bushels.	Average height which every Head lifts in Inches.	Times which every Head lifts at a Stroke.	Number of Strokes.	Weight of Heads and Lifters in Pounds.	Pounds lifted one foot high by a Bushel of Coal.	Strokes per Minute.	ENGINEERS.
		ft. in.										
1.—WHL. VOR.	Old Stamps 24 inch Double.	6 0	36	April 2d to April 26th.	652	9	2	516,890	13,380	15,911,015	15. 0.	A. Woolf.
2.—DITTO.	New Stamps Woolf's Engine.	4 6	48	Ditto.	986	9	2	521,390	18,760	14,880,237	15. 1.	A. Woolf.

Thomas Lean.

John Lean.

Sabbati, 7^o die Junij, 1817.

CHARLES HARVEY, Esq. in the Chair.

A LETTER from Mr. *William Lester*, with explanatory DRAWINGS, was read; as follows:

To the honourable Committee on the Construction of Steam Boats.

Gentlemen,

Mr.
William Lester.

I PRESUME that all the boilers of Steam Engines which have exploded by the pressure of the steam, have been in consequence of the nature, form, and position of the apparatus hitherto very improperly called the Safety Valve, which has been invariably placed at the command of the person attending the Engine, and thereby dependent upon his attention, and so constructed, that he can add to or take from what weight he pleases; and who is always taught to understand, that the more weight be puts upon this valve the more power the Engine will have, without being at the same time fully apprised of the danger that might arise from an overcharge, in consequence of the least lapse of his attention. This, by the number of dreadful catastrophes that have occurred, fully proves, that whatever is left to the constant attention of man, cannot be safe. The Engine, by its own motion, opens and shuts the nossal valve, and thereby feeds the cylinder with the proper portion of steam which is necessary for its own action, and also discharges that steam when it has performed the operation of pressing down or raising up the piston; but as the degree of heat, that raises that steam in the boiler, is always varying, more steam is raised at times than can be exhausted by the working of the Engine. This superfluous steam, accumulated by an increasing heat, renders an outlet necessary to carry it off as fast as it is raised. This outlet for the discharge of this superfluous steam renders a valve for the purpose of economy and safety indispensable, and which should be so constructed and placed, that the attendant or any other person could not approach it. That it should at all times act entirely independent of human attention, and solely by the pressure of the superfluous steam, which would enable the Engine to perform this operation with the same continued regularity and accurate effect, as it does that of opening and shutting the valve betwixt the boiler and the cylinder, and by that means entirely remove the possibility of explosion. This valve or apparatus should be loaded with a given and necessary weight, that cannot by any human means receive an addition; and so constructed as to have no friction, or be liable to any kind of lockage from the expansion of the heated metal, but to regularly recede from the increased pressure of the superfluous steam, and open the passage for its escape into the atmosphere.

The term used by Engineers for high and low pressure boilers, requires some explanation, for, as it is generally used, it implies that they are a distinct species; whereas every boiler, of whatever form or construction, is high or low pressure according to the degree of heat that surrounds it. The difference is, that one kind of engine requires more power upon the inch than another, to overcome the atmospheric pressure; as in one the steam is condensed by cold water, and from the other the steam is thrown off into the air without condensation. It follows, of course, that the latter requires more power than the other, and should have boilers made of a proportionate strength. But as all metals, whether cast or wrought, are liable to be weaker in one part than they are in another, (the weak parts of which are not visible to the most accurate inspection, and can only be discovered by submitting the boilers to proof,) I would beg leave to suggest, that an officer be appointed by Government to prove all boilers, at the proper periods of time that may be deemed expedient, for all engines that are employed for the conveyance of passengers, and all boilers that may be used for other purposes with high pressure steam, where the lives of His Majesty's subjects are endangered.

If

If your honourable Committee should deem it expedient to recommend to the House, legislative measures to compel the proving of all boilers that are liable by explosion to endanger the lives of His Majesty's subjects, such measure cannot in any way affect the interests of this or that species of engine, or impede the progress of improvement, as the public might be left at liberty to use every kind of engine that is or may be made, but subject to the necessary proof and other means to prevent explosion. This, I presume, would operate as an encouragement to the art, by establishing and restoring that confidence which has been so much shaken by the late catastrophes.

As all steam engine boilers have hitherto been liable to explode, from the accumulated pressure of steam, in consequence of the imperfection of the apparatus called the Safety Valve, I beg leave to offer to your honourable Committee, a calculation of the expansive force of the steam in different sized engines, which, I have no doubt, will make obvious the necessity of some parliamentary regulation in the application of this tremendous and powerful agent. It only requires a few figures, and the perusal of the evidence before your honourable Committee, to show the necessity of something being done without delay, for the sake of humanity, least another cargo of passengers be destroyed before the necessary precautions can be adopted.

A boiler for a 14 horse power engine should contain 60 superficial feet on the surface of the water, and produce 300 cubic feet of steam per minute, of the expansive force of five pounds upon the inch for a condensing engine, amounting to 72 tons expansive force upon the inner surface of the boiler, containing 162,280 inches and 230 cube feet of steam-space. If used as a high pressure boiler, working at 40 pounds upon the inch, the expansive force within the boiler will be equal to the weight of 576 tons, which steam must be raised from the water in less time than one minute to keep the engine at work. If any impediment or obstruction should prevent the action of the safety valve, and the engine cease working, then according to the ratio of increase, the expansive force would accumulate, in less than three minutes, to the amount of 1,152 tons pressure upon the inside of the boiler.

A boiler for a 20 horse power engine contains 90 feet upon the surface of the water, the boiler 15 feet long, six feet wide, and seven feet high, having on the inner surface 280,800 inches, which at five pounds upon the inch, amounts to 127 tons expansive force, at 40 pounds upon the inch to 1,016 tons. The cylinder, containing 17 cube feet of steam, which it exhausts 30 times per minute, amounting to 540 cube feet, which must be raised from the water in that space of time to keep the engine at work. Should the action of the safety valve be impeded and the engine cease working, the expansive force of the accumulated steam in the boiler would be doubled in less than three minutes, equivalent to the weight of 2,032 tons.

A boiler for an 80 horse power engine would contain 360 feet upon the surface of the water, and on its inner surface 1,123,200 inches, which, at five pounds upon the inch, would amount to 508 tons expansive force, and at 40 pounds upon the inch to 4,064 tons. If the engine stopped working, and the safety valve did not act, the increase in three minutes would amount to 8,128 tons. If this boiler was to be made strong enough to support the pressure of 600 pounds upon the inch, the expansive force would be equivalent to the enormous weight of 60,960 tons. How wonderful that more explosions have not already occurred!

I made many experiments last summer, on the apparatus called a safety valve, for the purpose of rendering a boiler safe which was fixed, and formed a part of the cabin of a canal boat; the result of these experiments was, the invention of an apparatus that has all the requisite advantages to do away the possibility of explosion. It has a weight that can receive no addition, which is always ready to recede when acted upon by a greater force than what it contains within itself. It has no friction, and cannot lock by the expansion of metals. It cannot be bound down or fastened by any means, without destroying the working power of the engine, or letting the steam out of the boiler as fast as it is raised. It acts at all times with one continued regularity when put in motion by the pressure of the superfluous steam, and that entirely without the attention of man. The weight is a column of water which can receive no addition

Mr.
William Lester.

in consequence of its fluidity, and recedes upwards from the pressure of the steam when that is stronger than its own weight. It will appear obvious, by the inspection of the working model or the accompanying sketches, that it is calculated, with the aid of the necessary proof of the boiler, to render explosion impossible, and thereby constitute a most perfect safety valve.

The accompanying *Sketches are the outlines of two Apparatuses* invented by me; one for the purpose of proving the strength of boilers, and the other for letting the steam escape when it arrives at a given pressure. The one for proving boilers, is far superior to the mode used by loading the valve by additional weight, as it is not like them subject to friction, and consequently is not liable to lockage. The weight pressed upon every square inch of the boiler is most accurately ascertained at the first view, whereby all errors of calculation are prevented. A boiler proved by this apparatus to the extent of 150 pounds pressure upon the inch, by an officer appointed for that purpose by Government, and the hydrostatic safety valve graduated to the working line, say 100 degrees below proof, properly attached, will never under any circumstances explode. It would be proper that the proprietor, or the engineer who attends the engine, should be furnished with a certificate, specifying the date and extent of the proof, also the working line of the safety valve, and signed by the proving officer. This certificate should be shown to any passenger demanding to see the same; by which not only the lives of His Majesty's subjects would be preserved, but their minds would be rendered perfectly at ease on the subject of safety.

I shall take the liberty to exhibit to your honourable Committee, a working model of my hydrostatic safety-valve, when I trust you will call before you professional men of science to examine its principle and action; as I should feel great pleasure if any gentleman could point out the probability of its motion being stopped or impeded, or anyways obstructed, by any external interference; or how it might be liable to any internal impediment, by which its motion may be rendered uncertain or irregular, not corresponding with the impulsive lifts and throws of the accumulating and superfluous steam. I conclude, that this apparatus, with legislative aid to compel proof, will make steam engines and steam boilers, of every description of form, size, or construction, produce with their own innate action, from the elasticity of their steam, their own security, independent of the least care or attention of man. With the hope of accomplishing this most desirable and important purpose, I shall endeavour to render all the assistance within my power, and trust that my humble efforts will meet the approbation of your honourable Committee; and that the honourable House of Commons, for the sake of humanity, will adopt such measures as they in their wisdom may think fit.

I am, Gentlemen,

Your most humble and very obedient Servant, at command,

London,

William Lester.

May 29th 1817.

A descriptive Reference and Explanation of the
DRAWINGS.

Fig. 1. A Hydrostatic Apparatus for proving the strength of Steam Boilers, by water injected from a force pump. A a cistern made of leather attached to a metal top, and filled with water, and inclosed in a metal Box. B a tube rising from the centre of the metal top, and communicating with the water in the cistern; the diameter of this tube being as 1 to 28 compared with the diameter of the box, the area of which will be as 1 to 588. A column of water in the tube B an inch square and 35 inches high, would press upon the piston C the weight of 588 pounds, suppose the piston C to be one inch in diameter. Water being forced with a force pump into the boiler, when full will press against the piston C, whose cap or flange acting upon the leather which supports the water, with the force of 588 pounds, before it can force the water in the tube B above 35 inches high, allowing the tube B on the piston C to be one inch in area, which would give a pressure of that amount upon every inch of the boiler. The tube B is made of glass and marked with an index of figures, denoting the pressure at different heights, and the reservoir or bulb D filled with oil coloured, which leaves a mark within the tube, showing how high the pressure had been made in the boiler.

Fig. 2. A Hydrostatic Valve or Apparatus, connected by a tube with the steam space in the top of the boiler. A a cistern of water made of leather, which when pressed upwards by the steam acting upon the valve C forces the water into the chamber B as seen in Fig. 3. When the steam is exhausted to the same pressure as the weight of the column of water in the tube E, acting upon the leather at the bottom of the box A, the valve C closes, and remains so till the steam in the boiler gets up to a higher pressure.

Fig. 3. C shows the Valve up and the steam rushing out. B the water which has risen from the box A by the rising of the valve C and which returns on the valve's closing into the box A as seen in Fig. 2.

Fig. 4. B the Receiving Chamber which is covered at the top securely, but perforated with diagonal or other irregular sized holes, to prevent the possibility of the tube E being stopped or closed by any external interference. D a funnel through which the water is put to fill the box A. The stem of the valve F being made of wood, prevents the leather in the box A from being injured by the heat of the steam.

Fig. 5. The Valve, with a concave top and a concave bottom. On this the leathern cistern of water presses, as shown in the other figures.

This Hydrostatic Valve is self-acting, and evidently secure; it cannot be injured or loaded by any external or internal violence, without letting off the steam; and therefore the injury, if any should occur, is on the safe side: and would from its simplicity cost little to repair. It will admit no more weight than the height of water to the top of the chamber B of the same area as the tube E. Its power and weight are always in proportion to the height of the tube E, compared with the valve-seat C, and the horizontal area of the top of the box A. In this figure, the box A, is 14 times the diameter of the tube E, which is in area as 1 to 147; consequently, the height of the tube E must be governed by the weight required upon the area of the valve-seat C. This water or hydrostatic lever, has a very great advantage over all others for this particular purpose, as it never can be thrown off its centre of action by any probable inclination, rocking, motion, or violent concussion, which either vessel or carriage may be liable to. When the water in the tube E is wasted by evaporation, it may immediately be supplied by means of the funnel D, as shown on the chamber B, Fig. 4.

W.^m Lester's Sketches of Apparatus
for Proving
STEAM ENGINE BOILERS,
and of improved Safety Valves.

1817.

Fig. 3.

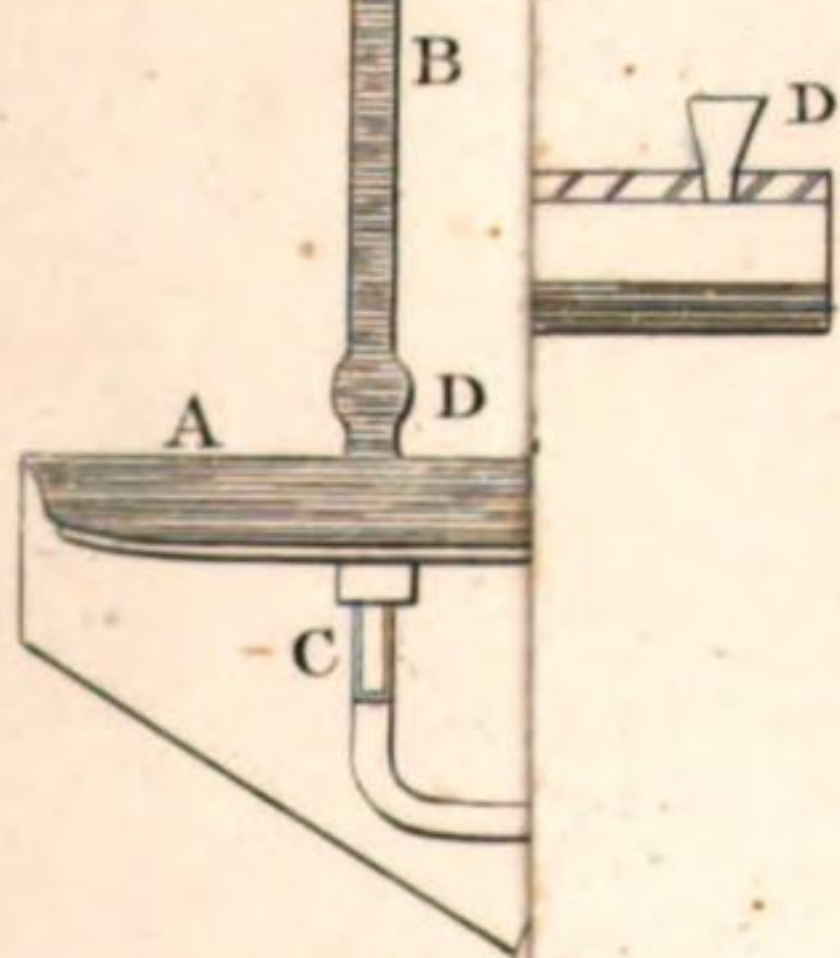
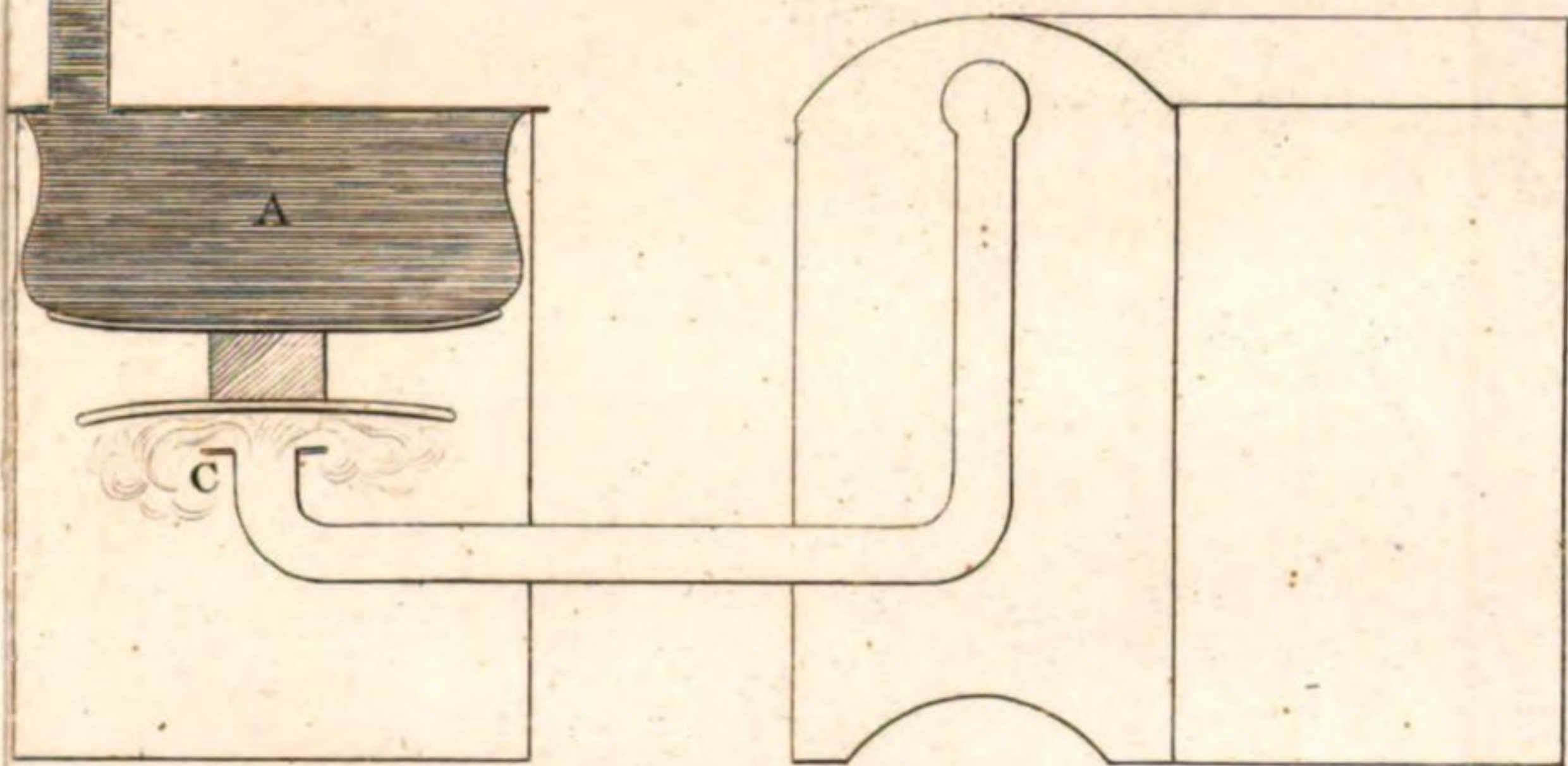
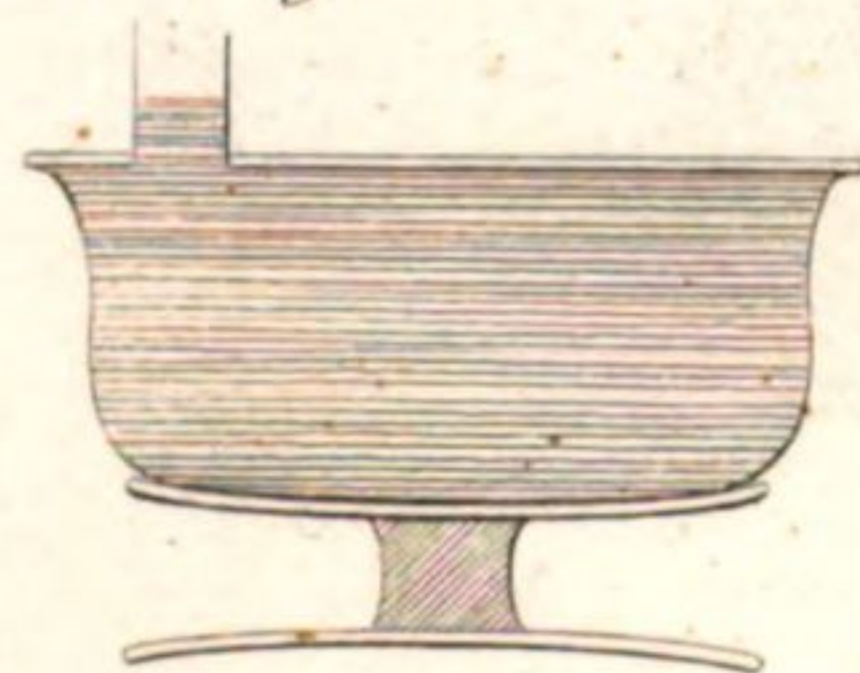


Fig. 4.



Fig. 5.



R E P O R T

FROM THE

SELECT COMMITTEE

ON

STEAM ENGINES AND FURNACES:

&c.

Ordered, by The House of Commons, to be Printed,

12 July 1819.

R E P O R T

FROM THE

SELECT COMMITTEE

THE REPORT	- - - - -	p. 3.
MINUTES OF EVIDENCE	- - - - -	p. 5.
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STEAM ENGINES AND FURNACES

By

Ordered by The House of Commons to be Printed

18 July 1819

R E P O R T.

THE SELECT COMMITTEE appointed to inquire how far it may be practicable to compel Persons using STEAM ENGINES and FURNACES in their different Works, to erect them in a manner less prejudicial to Public health and Public comfort; and to report their Observations thereupon to the House;—HAVE agreed upon the following R E P O R T:

THAT from the advanced period of the Session, at which the appointment of Your Committee took place, it was not to be expected that they could form any ultimate decision as to the precise object of their inquiry; but as far as they have hitherto proceeded, they confidently hope that the Nuisance so universally and so justly complained of, may at least be considerably diminished, if not altogether removed.

Your Committee have had under their examination, Men whose minds have been long and practically directed to the extinction of the evil; and from their Evidence, as well as from the Plans which will be found in the Appendix, the House will be enabled to judge, how far their opinions correspond with those of Your Committee.

The disinterested communications made by Persons whose private interests might have led them to a different line of conduct, cannot be too highly valued and extolled.

12 July 1819.

R E P O R T

WITNESSES.

Mr. Joseph Gregson	p. 5.
Dr. Edward Roberts, of Bloomsbury-square	p. 8.
Mr. William Moulton	ibid.
Mr. John Walker, jun. Bricklayer	p. 9.
George Leman Tuthill, M. D. of Soho-square	p. 10.
Mr. William Losh, of Newcastle-upon-Tyne	p. 12.
Mr. William Brunton, of Birmingham	ibid.

Your Committee have had under their examination, Men whose minds have been long and practically directed to the extinction of the evil; and from their Evidence, as well as from the Plans which will be found in the Appendix, the House will be enabled to judge, how far their opinions correspond with those of Your Committee.

The distracted communications made by Persons whose private interests might have led them to a different line of conduct, cannot be too highly valued and extolled.

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MINUTES OF EVIDENCE.

Lunæ, 14^o die Junii, 1819.

MICHAEL ANGELO TAYLOR, ESQ.

In the Chair.

Mr. Joseph Gregson, called in; and Examined.

WHAT is your business?—Generally surveying the defects of buildings, as the chimnies, drains, &c.

*Mr.
Joseph Gregson.*

Have you paid any attention to the nuisances arising from the smoke of manufactories?—Yes, for many years; but particularly within the last six years, when having some property to dispose of, situate in the neighbourhood of one of those nuisances, of the value of 400 *l.* per annum, I could not get the rent required, within 100 *l.* per annum.

Entirely owing to that nuisance?—The other objection was only the shortness of the lease, and that could not have reduced the rent 20 *l.* per annum.

Was it in consequence of that depreciation of property, that you paid more attention to this object?—Entirely.

Do you consider the nuisances to affect the health of populous towns?—In answering that question, I am aware it is allowed the health of this metropolis has increased since the use of coal; a brisk coal fire, causing a great circulation of air, promotes health. I am not however aware of a more unhealthy dwelling than one full of smoky chimnies; and I consider those nuisances in a large town in the same view as a smoky chimney to a dwelling.

Have they increased in any degree within your knowledge?—They appear to me to be daily increasing: in the town of Liverpool, I may say they have altogether appeared within the last twenty years, as at that time any person standing on the hill in Toxteth Park could see over the town, the ships coming in round the Black Rock; but now the mouth of the harbour can scarcely be seen during the week, although there is very little increase of buildings on the same ground, except those causing the increased nuisances.

What is your opinion of the cause of those nuisances?—There are, I consider, two great causes: one, the putting on the fire or furnace too much crude fuel at one time; the other, from the chimnies being commonly so very low, in proportion to the fuel consumed.

Are you aware of any practical means by which those nuisances can be removed?—Yes, I have seen it done effectually under steam engine boilers; but being generally attended with an increased consumption of fuel, it is seldom adopted but where the parties have been or are under an indictment.

Are there any means by which it can be effected with the same consumption of fuel as at present?—Yes, in small boilers where coke can be used instead of coal; but under large boilers, where a flaming fuel is required to operate on all sides, I am not aware of any plans that can practically effect the object better than those which I have invented.

Upon what principle, then, is your invention founded?—1st, By causing all the smoke, after it has arisen from the fire, to return into the heat of the fire before it enters into the flue or chimney, and so be consumed; 2dly, By putting on no more fuel at any one time than the smoke of which can be so consumed, and that without opening the furnace door for the purpose; 3dly, By supplying every fire with air, in order to counteract the effect of those winds that operate against the draft.

Has your invention been made public?—Yes; in the Journal of Arts and Sciences, edited at the Royal Institution of Great Britain, for July 1817.

Have you had much practice with it?—Yes; in the fires and boilers of private houses, under steam engine boilers, and in wealding furnaces.

What do you mean by a wealding furnace?—A furnace where a number of bits

6 MINUTES OF EVIDENCE BEFORE SELECT COMMITTEE

Mr.
Joseph Gregson.

and scraps of iron are packed together, and subjected to an intense heat; they are, in that state, then rolled or hammered into one compact body.

What was the result of your practices in those furnaces?—The result was, although every thing acted to the plans laid down, and the fire regularly supplied with fuel, and the smoke completely destroyed, yet the heat necessary to weald those scraps of iron together could never be attained.

Why could it not?—In consequence of the continued repetition of the supply of fuel, damping and preventing that heat coming over, which arises after all the volatile parts of the fuel have been driven off; and which heat, being entirely pure, is called a white or wealding heat.

Are we then to suppose that the constantly supplying of fires with fuel cannot be practically adopted in all furnaces?—Certainly not, but only in those requiring what I have before called a white or wealding heat, or any intensity above that; but in furnaces not requiring that heat, the constantly supplying them with fuel will not only be attended with the destroying of the smoke, but also with beneficial effects in the saving of fuel.

Enumerate the furnaces that you consider above the white or wealding heat?—The furnaces requiring a white heat and higher degrees, are wealding, melting and smelting furnaces, and vitrifying furnaces, as the making of glass and porcelain.

Cannot all those furnaces be worked with coke?—The melting and smelting furnaces are in many instances supplied only with coke, but I do not consider a wealding or glass furnace can be at all worked with coke.

You then consider that all those furnaces requiring above a white heat, cannot well practically have their smoke consumed?—That is my opinion.

Will raising the chimnies have a good effect?—Yes; by increasing the draft, the smoke will be then more consumed, and by its height more dispersed by the wind.

In what proportion do you consider the chimnies should be raised?—For every fire, consuming one bushel of coals per day, the chimney should be at least thirty feet high, and one foot higher for every additional bushel consumed, measuring from the body of the fire.

Upon what grounds do you give that opinion?—Not only from theory, but by practice; the good effects, where I have seen that plan in any degree adopted, it has produced.

Would it be beneficial to those furnaces, where you consider it impracticable, to destroy the smoke?—Certainly, upon the grounds I before mentioned.

How many steam engines are you acquainted with where the smoke is consumed?—The new steam engine of 100 horse power at the East London Waterworks, Old Ford, there is a method of consuming the smoke; a singular plan is adopted at the corn mills at Islington, Liverpool; at the corn mills Newcastle, Stafford, a steam engine, of 14 horse power, I have seen work for nearly a whole day without smoke, owing to the quality of the coal, which was only 5*d.* per cwt.; at the lead mills, Tottenham Court Road, a small steam engine is worked with coke only; at a brewery in Salford, a small steam engine, and a large one at the Meddock Mills, Manchester, consume the smoke on the patent principles; in all, six different engines. I must, however, remark, that under the very best circumstances and contrivances, there are times in which the smoke of crude fuel cannot be consumed, viz. at the first lighting of the fire, and at any sudden changes of damping or raising the fire.

Do you know any instance in which your patent, or the principle of it, has been applied with effect?—I know of two instances, in which an approach to the principle of the invention has been applied with success; namely, Mr. Hardman's brewery, at Salford, and at the Old Medlock Mills, at Manchester.

What would be the difference of expense of your plan, as compared with the old principle, in setting up a steam engine?—In setting up a six horse engine, it would be about 16*l.*; and a thirty-six one, about 30*l.* or 32*l.*

The application of this patent would increase the expense to such an amount?—Yes.

Do you mean that an old furnace could be altered for 16*l.*?—Yes.

Would it not create an increased consumption of fuel?—No.

How will it affect that question?—It will be about one-tenth saving of fuel; it will be upon the gaining, and not the losing side.

With the old furnace, are you not of opinion, with proper management, that the smoke might be consumed?—Not precisely as they are at present constructed. If you

you use all round lumps and knobs of coals, and don't put any small coals on the fire, you may consume the smoke, as at the Salford furnace, but that is entirely owing to the quality of the coal.

Does not the consumption of fuel in those engines vary precisely according to the extent of them?—It does not increase with the extent, but diminishes in proportion.

So that, in point of fact, the expense of the application of this patent would be shortly saved by the saving of fuel?—Yes.

Would this principle apply to the steam packets?—I had that object in view when I took out the patent.

And it would apply equally to this as to the common furnace?—Equally to stationary as to moving engines.

Are there any instances in London, in which this principle has been already applied?—The only one to which it has been applied was over the water, and that has been pulled down. I expect in a short time to apply it to a distillery.

Have you heard how the furnaces in Manchester have succeeded?—I had a letter the other day, from which I understand they go on very well.

And the smoke continues to be consumed?—Entirely to be consumed.

At this moment there are none existing in London to which it has been applied?—None, except only in small coppers and common fires. There are no instances in which it has been applied on a large scale; the instances are of coppers in private houses, and fires in rooms.

Is the success entire, when it is applied?—The smoking of a common chimney is removed by a common fire being constructed on that principle.

Is there no appearance of smoke?—Yes, there is, because we cannot obtain that heat in a common fire that we can in a close fire.

The Committee understand you to say, that this new principle does not answer, unless there is considerable attention paid to the proper supply of the fuel?—Not in large fires. The engine at the East London Waterworks still makes a smoke, but not one quarter the quantity it would without the application of this principle.

But if the fuel is applied carelessly, it will still smoke?—It will make about one-fourth of what it would if the principle was not applied at all; but if the fuel is supplied with machinery regularly, it will make no smoke at all.

But even supposing the coal is incautiously used, still it will save three-fourths of the smoke created under the old system; you mean to say that?—Yes.

What would be the expense of altering an old engine of a hundred horse power, upon the new principle?—Not less than £. 100.

Then, as the consumption of fuel is less in proportion according as the power increases, so in applying your patent to a large power, the saving would be slower in proportion?—Yes.

Have you got a plan of your invention?—Yes, here it is.

[Witness produced the plan.]

Appendix, No. 1.
Plate I.

In the most perfect application of your invention, will there still be some vapour issuing from the furnace; and if so, from what does it arise?—Yes, there will be, but it will be scarcely visible.

Will that vapour merely be the result of the ignition of the smoke?—It will be aquatic vapour rarefied.

Will it be the exclusive result of the ignition of the smoke?—Yes.

In your examination you have stated, that what comes out of the chimney after the smoke is burnt, is aqueous vapour or rarefied steam; state what you consider the difference between the burning of the smoke and the burning of coal gas?—In the making of gas, the coal is only subject to a red heat, and the gaseous vapours of which may be considered as distilled over, while the principal part of the fuel remains as coke; but in a common furnace the coal is entirely consumed, leaving only ashes or a vitrified clinker; the smoke containing much ammoniacal matter, cannot be burnt but in a very intense heat, approaching to a white or welding heat; consequently, when the smoke is burnt under the boiler it is very destructive to the metal; but being burnt in the manner I have explained, that destruction is wholly avoided; the smoke is thus subjected to the required heat, an entire change or decomposition takes place, and the product is principally steam; whereas the coal gas never having been subjected to that heat, there is greater difficulty in freeing it from its impurities; therefore the vapour arising from burnt smoke is more pure than that arising from the burning of coal gas.

Doctor Edward Roberts, called in; and Examined.

*Doctor
Edward Roberts.*

YOU are a practising physician, living in Bloomsbury-square?—Yes.

Have you turned your attention at all to the subject of smoke, and its effects upon the health of the population of London?—I have long observed that it is a great nuisance, as it appears to me; and I consider it prejudicial to the health of persons exposed to its influence.

Do you observe that those parts of the town which are more infested with smoke, are less healthy than those which are more free from it?—I cannot speak of any very prominent instance; but I have considered that it was so, in more families than one.

The Committee conclude, that in the course of your general observations, you have observed, and can specify some instances in which this has been a nuisance, and which would probably produce the results you allude to: can you name any one of such instances?—Yes; I can state, that even the other day, in passing through Great Russell-street, Bloomsbury, I observed the street stifled with smoke issuing from a neighbouring brewery, and extending from Oxford-street, where the brewery is situated, far beyond the British Museum.

Do you consider that persons living in a situation constantly exposed to smoke, in the way you have described, would find their health impaired by it?—Certainly I do.

Will you state to the Committee in what way you conceive the air, being overcharged with smoke, would operate upon the health of the population so exposed to it?—I certainly should say, that air so loaded with impurities, cannot be so respirable as is necessary to the health of the population. From this cause, the air loses its elasticity, and cannot be properly ventilated.

Do you think that smoke has a tendency to generate particular disorders?—I do not.—I only mean to say, that it vitiates the pure air, and mechanically deprives it of the power of ventilation.

You conceive then it would tend to impair the general health of the population?—Yes.

And thus shorten human life?—Yes. It deprives the air of its vital principle, and produces an unwholesome atmosphere. I have been accustomed to notice this for many years, and I have had it much at heart. I have seen the smoke of London in one continuous line for ten miles, like a cloud.

Have you observed any great increase in the quantity of smoke of the metropolis within the last twenty years?—Yes, to a very great extent.

Do you think the general health of the population of the metropolis, in those parts most exposed to this increase of smoke, has deteriorated within that period?—Yes, I think so.

Mercurii, 16^o die Junii, 1819.

Mr. William Moult, called in; and Examined.

*Mr.
William Moult.*

WHAT are you?—I assist Messrs. Cooke, and am in the habit of putting up evaporating furnace boilers; I have erected one for Messrs. Cooke, whom I occasionally assist.

State where it is, and the nature of it?—At Stow Brow Allum Works, near Whitby, belonging to Messrs. Cooke. My method of putting up boilers is this: the former mode of heating the boilers, was by putting the coals over the bars in the common way; but my method is to make the flame come over the coals, which are laid upon an iron plate, and the flames made to pass over the surface of the coals upon the iron plate which light the coal at the top, and the red part of the coal is next the bottom of the boiler; by that means, the smoke as it rises from the coals is consumed in its passage over the bars. I put another up at Peak, about two miles from the first place, likewise belonging to Messrs. Cooke; I put that up by way of saving coals.

What was the saving of fuel?—The consumption of fuel of the old boiler was regularly eighteen bushels of coals in twenty-four hours; but when altered in this manner, twelve bushels produced a similar effect.

Was

Was the smoke completely consumed by this method?—Not completely; but there was no more smoke than from a common chimney.

I presume, from what you say, the smoke bore no proportion to what it was under the old method?—Not at all. I put up a small boiler for a steam engine upon the same plan, and found it answer.

Can you furnish the Committee with a sketch of it?—Yes; I will bring it on Friday.

Is the furnace to which you allude, such a furnace as can be used in any manufactory, such as soap, and other articles of that nature?—I think it would be applicable to soap manufactories, because their boilers are generally long boilers: in some steam engines, I think, from situation, it would be difficult to do it, because the fire is obliged to rise in the front, and pass that way. The present mode is to have bars in front, and to put the coals upon these bars; and they would have to put the coals beyond the bars, which would be a great distance from the mouth of the furnace. I think it would be rather inconvenient to get to the coals, and to get them beyond the bars.

Is there any increase of expense in the furnace you erected for Messrs. Cooke?—The difference of expense was, that the former bottoms of the flue were brick-work, but when it was altered to this way of heating the boiler, iron plates were put along the top, for the purpose of preventing the coal-rake from drawing up the brick-work; that was the only reason why the iron plates were put.

So that the only additional expense is the iron plate?—Yes; that was the only difference of expense.

What may that amount to?—I really do not know; but it may be done with the Welsh fire clumps.

Does the plan pursued by Messrs. Cooke effectually answer?—Yes, it does.

How long is it since they adopted that plan?—I think in 1810. The manufactory stands not far from the house in which Mr. Cooke resides when he is down in that part of the country. The smoke, when the wind was in a particular direction, used to annoy the house; but after the furnaces were altered, it was found to be very little annoyed by the smoke.

Have you at any time been employed in erecting steam engines?—Not exactly in erecting steam engines; I have attended to them; and I did erect one of my own invention, a mercurial one, but it was found not to answer, so that I did not go on with it.

Have you seen any other furnaces, or been employed in any, besides what you have described?—I have seen one putting up now by Mr. Smart at Westminster Bridge.

Having seen the plan given in by Mr. Gregson, what is your opinion of it?—I think it a very good one, because the passage at E will admit fresh air and keep up the flame; if it was to be shut, the flame would not extend so far.

Veneris, 18^o die Junii, 1819.

Mr. John Walker, jun. Bricklayer, of White Hart Row, Kennington Cross, called in; and Examined.

CAN you give the Committee any information as to the erecting of steam engines and furnaces so as to consume their own smoke?—I have brought with me a plan; [*producing it.*]

Have you ever put this plan into practice?—No further than trying it by way of experiment.

According to the plan which you have produced, will there be any saving of fuel?—Seventy-five per cent.

Is it necessary in this plan to use coke instead of coal?—Yes; which I make myself, and which any person may do.

Is this applicable to furnaces and steam engines?—Not to all sorts of furnaces: the principal things it will be applicable for in London, will be the steam boilers, brewers coppers, stills, soap coppers, and tallow-melters coppers; and what it will be more advantageous for, will be, that with a trifling expense it will consume the whole of the stench which evaporates from the hole of the copper, which is a very great nuisance in London.

Mr.
John Walker.

Appendix, No. 7.
Plate IX.

Mr.
John Walker, Jun.

What additional expense will this occasion?—In a new erection there will not be any additional expense; the expense of the alteration must depend upon circumstances, but it cannot be large.

Is there any expense of repairing necessary?—I will guarantee, that for three years there shall be no expense of repairing.

Are the Committee to understand there is a greater or less expense of repairing upon this than upon the common mode?—There will be a less expense upon this.

After the three years will it require an annual expenditure?—No; the repair will be the same as the common repair is now for a fire-place only, and then it will go for the same term again, therefore there will be a saving of expense in repairs generally.

What will be required; new fire-bricks?—Yes; the furnace bars will be about the same as they are now; there will be very little difference.

Are you about to erect one of those engines?—I am going to alter an old one at Mr. Randall's starch manufactory, Princes-street, Lambeth, in the course of a very short time.

George Leman Tuthill, M. D. of Soho-square, called in; and Examined.

George Leman
Tuthill, M. D.

HAVE you turned your attention to the unhealthiness arising from smoke?—I believe the atmosphere of London to be prejudicial to health; the accounts which have been published at different times, concerning the relative duration of life in London and in the country, may be considered as having proved that duration to be considerably diminished by a residence in this metropolis. It is probable that this depends upon the atmosphere of London. There are a great variety of causes which contribute to render that atmosphere unfavourable to health; and I think we may be warranted in assuming, that whatever we can discover in such atmosphere, so as to render it different from that of the country, may contribute to produce this effect; and therefore it becomes probable that the quantity of carbonaceous matter suspended in it, is one of the causes of its insalubrity. The rapid advancement to recovery which we frequently see in sick persons, during a short residence in the country, proves the influence which the atmosphere of London has upon health; there are many diseases incident to the human body, in which the influence of that atmosphere may be more easily detected than in a state of health. In certain diseases of the lungs, especially, I think it may be proved that the smoke of London is prejudicial. I conceive that the fog peculiar to London, so different in its sensible properties from any fog in the country, depends upon the smoke of the metropolis, and is prejudicial in many diseased states of the lungs.

If you have looked into the bills of mortality, on contrasting London with other capitals in Europe, do not persons live longer in London, in proportion, than in any other capital in Europe?—I do not know the relative duration of life in the different capitals of Europe; but I do not think it would prove that the smoke of London is harmless, supposing longevity were in favour of London.

Is there no other circumstance affecting the lives of persons in great cities, besides the smoke?—Certainly, a great variety.

Do not you know, that in smaller towns, the people quit those smaller towns for the benefit of the air in the country?—That benefit, I think, is not so remarkable as in sick persons who leave London for the country.

Do you not think so many persons breathing on the same ground, might operate on the health of individuals breathing the same air?—The greater be the quantity of carbonic acid gas in a given volume of air, the greater would be the insalubrity of that air. But in crowded cities, the air is contaminated from a variety of other causes, which chiefly owe their origin to the exhalations, either from the living animal body, or from decomposing animal and vegetable matter, when the principle of vitality is extinct.

In two towns in the country, where there appears to be more smoke than in London, in Birmingham and Manchester, have you examined the bills of mortality?—I am not acquainted with the bills of mortality, either in Birmingham or Manchester.

Do not you think the goodness of the water as one of the principal effects upon the health of the inhabitants of a city?—Certainly, that has a great effect.

Have you turned your attention to any mode, by which those violent tornados of smoke emitted from furnaces, might be prevented?—I believe it possible to prevent them.

Must

Must not that very thick volume of smoke emitted by furnaces, brewhouses, soap manufactories, gas houses, &c. be exceedingly prejudicial to the health of the inhabitants?—I believe it to be prejudicial.

Much more so than the common smoke, evaporated by ordinary flues?—That depends entirely upon the quantity of smoke emitted, and upon the increased quantity of carbonic acid gas which is produced by the combustion of so large a quantity of coal.

Can you state any particular plan or system you would recommend, to prevent these injurious effects?—I conceive the smoke arising from such furnaces might be prevented; that is, that the carbonaceous matter which issues from such chimnies, and now mixes with the atmosphere, may be converted into carbonic acid gas.

Have you turned your attention to any mode of effecting that?—I think it can be effected by making the smoke pass through an ignited tube, whilst the combustion of the soot is there assisted by a fresh current of atmospheric air. I see no reason why a simple apparatus may not be so contrived, as to render that combustion complete. But it appears to me to be deserving of consideration, whether this annihilation of smoke ought to be confined to manufactories. If, instead of burning common coal, that fuel were first divided, as it now is in the gas-light manufactories, into coke and carburetted hydrogen gas, and these were afterwards consumed in union, the brilliancy and warmth which we now enjoy by our fire-sides, would, to say the least, be undiminished, whilst the smoke would be entirely destroyed. This may be tried without any difficulty, by the judicious admission of gas into a common grate filled with coke; the materials in fact would be the same as of our common fires, but employed in a state of greater purity. There is no limit to this mode of destroying smoke; and should a plan of this nature be hereafter adopted, chimnies as they are now constructed would be quite unnecessary; a small tube would be sufficient.

The complaints produced by smoke, you are of opinion, are chiefly consumptions?—My answer to a former question seems to have been mistaken: I merely stated, that persons affected by diseases of the lungs, suffer from the air of London; asthmatic persons, for example, are often seen severely affected by London fog.

Do you think it creates asthma?—I do not know that it creates it; but there are different causes which probably concur to produce diseases, and those may be capable of exciting asthma in a person subject to it, which would not produce it where no predisposition existed.

Have you been in the habit of burning wood fires?—Not in this country.

Do you find any difference between a wood fire and a coal fire, in respect of health?—It is, from the many atmospheric causes by which health is disturbed, scarcely possible satisfactorily to answer this question: but even supposing all other disturbing causes in the atmosphere of two great cities, such as London and Paris, to be the same, it is obvious, that the smoke from coal fires would, from its being a constant source of annoyance, be objectionable.

How a constant source of annoyance?—By producing painful sensation, and consequently diminishing human comfort and happiness. It is the constant source of complaint by foreigners upon their arrival in London; and although we are now accustomed to the evil, it was the cause of great complaint upon the introduction of coal fires into our metropolis, as appears by a small volume, published by Evelyn in 1661, for the very purpose of preventing the evil to which the legislature may possibly now think it expedient to endeavour to apply some remedy.

Have you known particular instances of persons' healths suffering by living in the neighbourhood of any of the engines referred to?—No, I have not.

Do you know whether there is any difference in the chemical effect upon the air, between a wood fire and a coal one?—If the coal employed contain sulphur, that will affect the products of its combustion; and pyroligneous or acetic acid, holding a little essential oil and ammonia in solution, may be produced during the combustion of wood, and mix with the atmosphere where the latter fuel is employed.

Does it rarefy the air more?—I believe not.

A fire constituted with materials such as you have alluded to, would not have any bad effect upon health, would it?—No more than the production of carbonic acid gas, which would be equally produced in the burning of wood. The atmosphere of London might then become as clear as that of the country; and if required, the carbonic acid gas might be conducted away to any distance.

*Mercurii, 30^o die Junii, 1819.**Mr. William Losh, called in; and Examined.**Mr.
William Losh.*

WHERE do you reside?—At Newcastle-on-Tyne.

Have you ever taken into consideration the mode by which the inconvenience arising from the smoke of furnaces and steam engines can be remedied?—Yes: it is impossible to state any thing which will be satisfactory, without referring to a plan. I can only state, that in some engines which I have erected according to my plans, the smoke is entirely consumed.

Have you any of those plans with you, by which it is contrived to prevent the smoke, so loudly complained of, from issuing?—I have.

Have the goodness to deliver them in to the Committee?—These are they.

Appendix, No. 2.
Plates II. & III.

[The witness delivered in the following plans.]

Where have you erected works corresponding with the plans which you have put in?—At Walls-end colliery, Newcastle-on-Tyne, at Killingworth, Northumberland, and Gateshead-park in Durham, and various other places.

Do you mean to state to the Committee, as far as you are able to judge, that they have fully succeeded?—Yes; we cannot perceive any smoke from some of the chimnies of those steam engine boilers, at least not so much as arises from a common kitchen fire.

Can the plan be applied to furnaces in breweries, soap manufactories, and other works of that nature?—Yes, I think it may generally; we have sent several of them out to the West Indies, and I understand they answer the expectations. There is further information in the specification, (which I will deliver in, if it is necessary), more than I have put in these plans; it is connected with the saving of fuel, as well as the burning of fuel.

Do you know of any means by which the same effect, namely, the reduction of the volume of smoke, could be effected in furnaces for smelting ores, or in those used for the making of glass?—I think, for smelting ores, long horizontal flues would be advisable, and would nearly do away with the nuisance; but for glass-houses, I really do not know of any practical remedy that could be easily practised.

How many years have you been conversant in this?—Twenty years.

*Mr. William Brunton, called in; and Examined.**Mr.
William Brunton.*

WHERE do you reside?—At Birmingham.

What is your general occupation?—Civil engineer.

Are you acquainted with the methods generally used for burning the smoke from the furnaces of steam engines?—Yes.

Describe the nature of these furnaces?—Furnaces for consuming smoke, as they are usually constructed, consist of two distinct parts: 1st, the grate upon which the coal is consumed; and 2dly, the feeding-mouth into which the coal is put (with the shovel,) preparatory to its being pushed forward upon the grate, at the end of the feeding-mouth; opposite to that which joins the grate, is fitted a door, in which are holes with covers, for regulating their apertures, by which atmospheric air is admitted at pleasure. The process is thus: whilst the coal already upon the grate is in high combustion, and has ceased to smoke, the coal in the feeding-mouth, being exposed to the heat of the fire, undergoes a degree of coking, and the smoke thereby evolved, combined with a portion of air admitted at the openings in the door passing into the chimney over the hot fire, is consumed. When the fire is to be renewed, the coal thus acted upon is forced forward upon the grate, still carefully preserving a strong fire of well burnt coal on the farther end of the grate, in order to consume the smoke, which will now be given out by the coal thus brought into active combustion; at this period a much greater portion of air must be admitted than will be needful, when the coal last forced forward has attained its full heat. It should be observed, that in order to render the working of these furnaces easy, the grate and feed-mouth are laid sloping about one in six higher at the end into which the coal is put, so that by its natural gravity, it is readily pushed forward. I have seen many modes of constructing these furnaces; but the principle of all is nearly the same, and the practical results very similar.

What

Mr.
William Brunton.

What objections are there to the general adoption of the furnaces you have described?—The following are in my opinion the principal objections: 1st. the process of coking, or preparing the coal in the feeding-mouth, is very imperfect, and but a small part of the coal necessary to feed the fire is affected by it, so as to give out less smoke when forced upon the grate; 2dly, though the judicious admission of air to enable the smoke to ignite be found advantageous, yet a small excess admitted is found to have a very injurious effect in cooling the boiler; and as the quantity of air required for the combustion of the smoke must vary every moment of the interval between the times of renewing the fire, (perhaps fifteen or twenty minutes) nothing short of the greatest care and unremitting attention to the admission of the air, can accomplish the object with economy. This care on the part of the workmen can very rarely be obtained; and proprietors of steam engines have found that, for want of this, the burning of smoke has been too expensive for them to persevere in.

Can you point out any means by which these objections may be obviated?—Having turned my attention for some years to this subject, I think I have discovered a method by which the smoke may be consumed economically, and its practicability less objectionable than the methods usually adopted: 1st. I put the coal upon the grate by small quantities, and at very short intervals, say every two or three seconds; 2dly, I so dispose of the coal upon the grate, that the smoke evolved must pass over that part of the grate upon which the coal is in full combustion, and is thereby consumed; 3dly, as the introduction of the coal is uniform in short spaces of time, the introduction of the air is also uniform, and requires no attention from the fireman. As it respects economy, 1st, the coal is put upon the fire by an apparatus driven by the engine, and so contrived, that the quantity of coal is proportioned to the quantity of work the engine is performing, and the quantity of air admitted to consume the smoke is regulated in the same manner; 2dly, the fire-door is never opened excepting to clean the fire; the boiler of course is not exposed to that continual irregularity of temperature which is unavoidable in the common furnace, and which is found exceedingly injurious to boilers; 3dly, the only attention required is to fill the coal receiver every two or three hours, and clean the fire when necessary; 4thly, the coal is more completely consumed than by the common furnace, as all the effect of what is termed stirring up the fire, (by which no inconsiderable quantity of coal is passed into the ash-pit,) is attained without moving the coal upon the grate.

[The witness produced a model before the Committee, to show the manner in which he puts his plan into execution.]

Where have you erected any furnace similar in its construction to the plan which you have shown to the Committee?—At the Eagle Foundry, Birmingham.

How long has it been erected?—It has been erected two years nearly; but I would beg leave to state that I have not had it at work for two years; I have been trying experiments for some time, but we have now got it to work, and we have received the thanks of our neighbours for obviating or removing the nuisance of the smoke.

What power engine is it?—A twenty horse engine.

Is the furnace applicable to engines of a larger description?—Perfectly so; we are going to apply it to one of the very largest engines in Cornwall, on the principle of economy, not regarding the consumption of smoke.

What may be the difference of the expense between the erection of that furnace and one of a different description?—I conceive, in a twenty horse engine, that the difference of the expense would be between 75 *l.* and 100 *l.*

Would that expense be compensated by the decreased quantity of fuel necessary to carry it on?—I conceive that it would.

Is it possible to explain, by any drawing, the nature of the model which is now produced?—Yes.

Have you any objection to favour the Committee with such a drawing, as the model cannot of itself be so generally known?—I will furnish it with pleasure.

Appendix, N° 6.
Plate VIII.

Is the furnace applicable to any engine now erected?—It is; our engine was erected before the furnace was erected; there is no occasion to disturb an engine already erected.

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— No. 1. —

Appendix,
No 1.

Plate I.

EXPLANATION of a Patent Smoke-consuming Furnace; referred to in
Mr. GREGSON's Evidence, p. 7.

IT will be observed in the plate annexed, the fire G and the feeding-door F is made as usual under all steam engines or other boilers, the smoke passing over the back plate or bridge marked D, excepting that under the said bridge is left an aperture through which a very strong and intense heat passes, and which heat inflames and consumes the smoke in the descending flue C, by means of the supply of air through the aperture E; it then passes through B into the common flue or chimney A, formed in the usual manner. Z is the air shaft or chimney to supply the fire with air through the valves X, and is conveyed there by the air drain Y.

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— No. 2. —

Appendix,
N^o 2.

Plate II.

EXPLANATION of a Plan for consuming Smoke from Furnaces;
referred to in Mr. Losh's Evidence, p. 12.

Explanation of the Figures*.

Fig. 1. is a plan or horizontal section of the furnaces for heating a sugar pan or still, taken at the level of the fire-bars. The space included within the dotted circle *a a a*, shows that part above which the pan rests when put upon its seat. *A* and *B* are the two furnaces; *b b*, the furnace-bars; *c c*, &c. their bearing-bars; *d d d*, flooring-plates; *e e, e e*, &c. bearers for the plates, and to support them in case they by accident should crack; *h h*, fire-doors and frames.

Fig. 2. is a plan or horizontal section of the pan and brick-work, at the level of the bottom of the flues (or at the lines *A A*, *A A*, in figs. 3. and 4.); *a* and *b* show the openings from the grate-rooms into the flues *i i i i*; *a* conveys the hot air, smoke, &c. from furnace *A*, fig. 1; and *b* the same from furnace *B* into the flues *i i i i*, and through them to the base of the chimney *j*; *n n* show part of the division wall, which separates the two furnaces (*A* and *B*, in fig. 1.) and which extends from the ash-pit to the bottom of the pan, which rests upon it, with a bearing of four-and-a-half inches. This wall is continued into the chimney, and for three feet up it, keeping the air, smoke, &c. of the two furnaces separated till they have taken their perpendicular direction, and can no longer interrupt each other.

Fig. 3. is a vertical or cross section of the pan and furnaces (at the line *A A*, fig. 1.) *a a a* show the pan; *b b*, the grate-bars; *c c c c*, the bearing-bars; *i i*, the side flues; *k k*, the ash-pits; *l l*, the grate-rooms; *n n*, the division wall (described in fig. 2.); *o o*, the wall surrounding and inclosing the flues. A view of the chimney is given behind the pan in this figure, in which *n n* are a continuation of the wall *n n* in the figure, and *j j* are the two flues continued three feet up the chimney.

Fig. 4. is a vertical section of the pan, furnace, &c. (at the line *B B*, in fig. 1.); *a a a* show the pan; *b*, grate-bar; *c c*, bearing-bars; *d d d*, flooring-plates; *e e e e*, their bearers; *f*, bottom plate for the fire-door frame to rest upon; *g g*, top plate for the same; *h*, the fire-door and frame; *i*, the entrance into the side flue; *j*, termination of the side flue in the chimney; *k* and *l*, same as in the last figure; *m*, the sliding damper, to regulate the admission of air into the ash-pit, according to the quantity required to keep up a due combustion of the fuel in the furnaces. These register dampers are shown more distinctly in fig. 6. *m m*, where one of them is open, and the other half shut; *o*, is the wall of the flue; *P*, a damper in the chimney. The arrow 1. shows the direction of the hot air in its ascent into the flue at *i*; and the arrow 2. its exit from the flue into the chimney at *j*; and these arrows may be supposed the same as those marked 1. and 2. in fig. 2.

Fig. 5. is a vertical section of the front part of the boiler seat (at the lines *A A*, in fig. 2, and *B B*, in fig. 4.); at the openings *a* and *b*, the hot air and smoke (from furnaces *A* and *B*, in fig. 1.) ascend into the flues *i i*, which are laid open for $22\frac{1}{2}$ inches by the section which cuts the wall *o o*, inclosing the flues (at *p p*, in fig. 2.); *l l*, are part of the grate-rooms; *k k*, the ash-pits; *n n n*, the wall which supports the pan and divides the furnaces; *d d*, the flooring-plates.

Fig. 6. is a front view of the boiler seat, &c.; *h h*, show the fire-doors and frames; *o o o*, show the brick-work surrounding the flues.

If it be required to burn the smoke, let there be dampers at *x* and *y* in fig. 2, and a perforation of the wall at *z*, figs. 1 and 3. Suppose both the fires, *A* and *B*, are burnt clear, and that *B* requires a fresh supply of coals, shut in the damper *x* and open *y*, then the smoke which sublimates from *B* will be forced over *A* and burnt in its passage. By reversing the action of the damper, the smoke of *A* may be burnt by furnace *B*.

* See the Specification of Mr. Losh's Patent in the Repository of Arts for January 1816.

Appendix,
No 2.

Plate III.

EXPLANATION of Plans and Sections of the Furnaces for heating an oblong Boiler ;
referred to in Mr. Losh's Evidence, p. 12.

Plans and Sections of Furnaces on Mr. Losh's construction *.

* See the Specification of Mr. Losh's Patent in the Repository of Arts for January 1816.

Fig. 1. is a plan or horizontal section of the furnaces for heating a steam engine boiler, taken at the level of the grate-bars. The area included within the dotted lines *aaa*, shows that part above which the boiler rests when put upon its seat; *A* and *B* are the two furnaces; *bb, bb*, the grate-bars; *cc*, &c. their bearing-bars; *ddd*, the flooring-plates, which prevent the air from penetrating from the ash-pit into the grate-room, except through the grate-bars and burning fuel; *eee*, &c. bearers for these plates, to support them in case they should by accident crack; *hh*, the fire-doors and frames; *gg*, the partition wall which separates the two furnaces and supports the bottom of the boiler; *J*, the base of the chimney.

Fig. 2. is a plan or horizontal section of the brick-work, &c. at the level of the top of the curved bottom of the boiler (or at the lines *AAA*, in figures 3 and 4); *aaa*, show the boiler; *fff*, &c. the flues; *ii*, a damper in the flue leading to the chimney; *J*, the chimney; *mmm*, the brick-work surrounding the flue; *n*, a damper to regulate the furnace *B* (fig. 1); *o*, a partition wall in the flue, which prevents the hot air from furnace *A* (fig. 1) passing immediately to the chimney, and obliges it to pass through the flue *fff*, &c. entirely round the boiler to the chimney *J*. The dotted arrow 1, shows the direction of the hot air in ascending from the furnace *A* to the flue. The arrow 2, shows that of the hot air from furnace *B*, which enters into the same flue; and at the arrows 1 and 2, the smoke and gases from both the furnaces are combined, and pass on together to the chimney at *J*, as is shown by the arrows 1 and 2, 1 and 2, &c.

Fig. 3. is a vertical and longitudinal section of the boiler and brick-work and furnaces (at the line *AA*, fig. 1.) The letters *aa*, *bb*, *cc*, &c. *ee*, &c. *ff*, *gg*, *hh*, *J*, *mm*, are explained in figs. 1 and 2, which explanation applies equally to this figure; *ddd*, are the flooring-plates which separate the ash-pits *kk*, &c. from the grate-rooms *ll*, and prevent the cold air from ascending from the former to the latter. The arrows 1 and 2, show the direction of the hot air in leaving the furnaces (*A* and *B*, fig. 1.) to ascend into the flues *ff*; *n* is a damper explained in figure 2; *P*, above this damper, is the point of junction of the heated air from the two furnaces.

Fig. 4. is a vertical and transverse section of the boiler, brick-work, &c. (at the lines *BB*, *BB*, figs. 1 and 3.) The letters show the same parts in this section as in the former.

Fig. 5. is a vertical section of the brick-work, &c. at the line *CC*, fig. 2; *P* shows the boiler. The remaining letters refer to the same parts as in the former sections. 1 shows the aperture through which the heated gases penetrate in their passage from the grate-room (of furnace *A*, figs. 1 and 2.) to the flue which surrounds the boiler.

Fig. 6. is an end view of the boiler and brick-work; *hh* *hh*, show the fire-door and frame; *ooo*, brick-work surrounding the flues.

N. B. Where it is of great importance to save fuel, it would be advisable to have register dampers on the ash-pits, by which the admission of the air might be regulated in the exact ratio required to keep up a due combustion of the fuel in the furnaces.

If it be required to burn the smoke by forcing it to penetrate with the atmospheric air through the grates and burning fuel, let there be dampers at *x* and *y* (the apertures of the furnace *B* and *A* into the flue), and let there also be perforations through the flooring-plates at *R* and *S*, with corresponding covers, and let there be doors or registers on the ash-pits, at *P* and *Q*.

Suppose the fires to be burnt bright, and that furnace *B* requires a fresh supply of coals; shut the damper *x* and open *y*; draw the cover of the perforation at *R*, and keep *S* shut; shut the ash-pit door or register *Q*, and open *P*. Then must the soot which sublimes from furnace *B* pass into the ash-pit through *R*, and be carried with the current of atmospheric air which enters at *P*, through the opening in the wall *O* to the furnace *A*, where it will penetrate through the grates and fuel, and be converted into gaseous products. By reversing the operation of the damper, the dense products of furnace *A*, may be consumed by *B*. When the smoke ceases to sublime, the furnaces can, in a few seconds, be made to act as described above, by which there is a great saving of fuel.

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— No. 3. —

LETTER from Mr. STEEL, with Plan and Description of his Mechanical
Smoke Burner; dated Dartford, June 30, 1819.

Appendix,
N° 3.

SIR,

INCLOSED is a sketch and description of the Mechanical Smoke Burner, which I promised to send, and which you will have the goodness to present to the honourable the Committee of the House of Commons, sitting on that business; should, on inspection, any apparent difficulties arise, or any other questions present themselves, I shall be ready and happy to furnish all the information I can: and

I remain, Sir,

Your most obedient humble servant,

Mr. White.

John Steel.

DESCRIPTION of a Furnace for burning Smoke, and feeding itself with Fuel, applicable
to Steam Engines, or any other of the purposes which Furnaces are applied to.

Plate IV.

A is a circular fire-grate of any suitable dimensions, which is moveable on an upright or inclined axis B, turning on a toe or centre C, and supported at the upper end D by a bar made fast in the brick-work; E, is a fluted roller, for the purpose of supplying the fire with coals (this roller or method of feeding the fire will admit of a variety of modifications); F, is the hopper where the coals are put for the supply of the furnace; the hopper ought to be furnished with a grate at the top (not shown in the drawing), so as only to admit of coals of a limited size, for the greater accuracy of the supply of the furnace. G G G, is an inclined plane, set at such an angle that the smallest of coals will slide down with facility, and the part H of the inclined plane may be made hollow, and kept full of water, by a free communication with the boiler, in which case it forms a part of the boiler. I L, are catch, screw, or common toothed wheels, so as to be worked by a catch motion, a screw, or common wheel work, or they may be worked by a band, chain, &c. M, is a common fire-door and frame. N, is a metallic plate for the ashes to drop on. O, is part of the boiler, which may be made in any shape or form. Fig. 1. represents part of a boiler of the common construction, and fig. 3. the end of a boiler with tubes; 1 1 1, shows the ring or rim, and 2 2 2, the arms of the rim which supporteth the fire or grate bars; the ring or rim is made a little deeper than the arms, and turns round in an iron trough, 3 3; this trough is to be filled with sand or ashes, &c. to prevent the air from passing between the rim and the brick-work*.

Now, suppose a fire to be lighted on the grate A A, coals put into the hopper F, and the grate A and roller E put in motion, it is plain, that such coals as lodge in the notches of the roller E will, as the roller turns round, be dropped on the inclined plane, and from thence scattered on a portion of the fire; and as the grate is moving round at the same time, another part of the fire is continually presented to each fresh supply of coals. It will be seen, fig. 2. by the direction of the arrow, as the grate and fire turn round from left to right, the coals that are dropped on the fire, are advancing toward the fire-door, or front of the fire; hence, all the smoke must necessarily be consumed. The letters R R show the direction which the coals take in the sections; see figs. 1. and 3; and where they are deposited on the grate, in the plan, fig. 2.

* I sometimes make the fire-bars hollow, and secure them all fast and water tight to the centre piece of the grate at P; each of the fire-bars, in this case, has a free communication with the centre pieces, and the centre piece with the boiler, through the pipe shown by the dotted lines Q; the outside of this pipe to be made water tight, in the inside of the boiler, by a stuffing-box.

Appendix,
N^o 3.

OBSERVATIONS:

IN feeding the fire by hand in the old way, it is well known that a great quantity of coals are thrown on at one time, and, at the first instant, the effect is literally a great tendency to extinguish the fire; but as the fire is usually powerful enough to overcome this, the next impulse is, the bursting forth of a large volume of dense black smoke, which has little or no heat to impart to the different objects with which it comes in contact; yet, had this smoke gone over a bright fire in small quantities, the whole would have been ignited and become a very essential part of the fuel, instead of passing out of the top of the chimney, and enveloping the whole neighbourhood.

In the new revolving smoke burner, the fuel being scattered on the fire by a well regulated motion, in such an infinity of parts that each particle becomes instantaneously ignited, and the smoke or hydrogen gas having to pass over the whole surface of the fire, the whole of the combustible matter must necessarily be consumed. In using this furnace where there is no steam engine, I employ any other moving mechanical power which the locality of the situation may point out, or it may be turned by hand.

If the mechanism of the smoke burner, should at any time be out of repair, in order to keep the work going on, it is only necessary to stop the wheel work, let the grate stand still, and feed the fire with the shovel at the fire-door, as in the usual method, till the parts are put in repair.

Answers to the proposed Questions.

Expense of erection and alteration of present furnaces?—Each alike, erection and alteration; and the estimated expense for a six horse engine, or furnace equal to that, 30 l.

Whether fuel saved, &c.?—There is a probability of a great saving in the fuel used, but cannot say to what extent; it is likewise presumed that small coals (at half price) will answer every purpose.

To what extent may they be carried?—They are equally applicable to engines and furnaces of the greatest magnitude, as those on the smallest scale.

Whether any erected, or about to be?—Likely to be one applied to a six horse engine, at Messrs. J. Hales and Sons, Steam Engine Manufactory, Dartford, in two or three months.

— No. 4. —

Appendix,
N^o 4.LETTER from Mr. WAKEFIELD, with Plans and Description of his Invention
to suppress Smoke by Combustion.

Plate V.

SIR,

Manchester, July 6th 1819.

I BEG leave to state to the Committee the principal objections that have been made to the burning of smoke, in order to show you the prejudices I have had to combat. It was said by the first practical gentlemen, that burning the smoke was a loss of 10 per cent. on the most improved plan, as well as difficult to execute, and injurious to the pans, by concentrating the heat; and when an engine was overloaded or the pan too small, that it could not be otherwise than make a heavy smoke; so that the idea of burning smoke was given up and treated with contempt. In 1790 and 1791, I had the superintendence of Mr. Drinkwater's mill, who was a magistrate, and wished to do every thing in his power to prevent his engine being a nuisance, and I turned my attention particularly to it; but although we succeeded then in making less smoke, we burnt more coals. Since that time, I became a water spinner in the country, and had not so much occasion for the use of steam; but on my return to Manchester, I found there had been no improvement made, and that the nuisance had become insufferable, which caused me to turn my attention particularly to it. Many persons were threatened with indictments to make them raise their chimnies, which answers no purpose, only carrying the smoke higher, so as to clear its own premises, but falls upon the next neighbour; besides, the lofty chimnies being dangerous, some have fallen, and persons been killed by them. On a reference to my statement, it will appear I have succeeded in removing all these objections.

I am, Sir,

Your most obedient humble servant,

M. A. Taylor, Esq. M. P.

John Wakefield.

TESTIMONIALS in favour of Mr. WAKEFIELD's Invention of suppressing
Smoke by Combustion.

Appendix,
N^o 4.

WE, the undersigned, have pleasure in certifying, from actual experience and observation, that Mr. Wakefield's method of constructing the fires of boilers, &c. to steam engines and other works, will be extremely beneficial, not only to the trader, but to the public at large; for independent of consuming entirely by combustion the gross and offensive part of the smoke, it will produce an increase of one-fourth of heat and power to each boiler, and a decrease of twenty per cent. in the consumption of coals; and at the same time, the boiler is less liable to injury, while the fire is not more difficult to manage.

Under these circumstances, we congratulate the inhabitants of this town and neighbourhood, as well as all other manufacturing towns, on the benefit likely to result from such an invention, combining (as it does) in its operation, health, economy, and other powerful advantages.

It is, therefore, to be hoped, that all persons using steam engines, and all printers, dyers, bleachers, distillers, and brewers, will be induced to resort to this expedient, not only from motives of private interest, but of general benevolence.

In confirmation of its efficacy, proofs may be seen at the following places, where several large boilers are thus constructed; viz. at the Factory of Mr. Jonathan Pollard, in Ancoats Lane; at Mr. Joule's, brewer, in New Bailey-street, Salford; and at Mr. Richard Gould's, Ancoats Factory; and also at several other places, on reference to Mr. Wakefield, Ancoats Place, whose attention, for several years, has been occupied in the accomplishment of this valuable object, and whose labours we hope will be amply compensated.

Moult and Holdens, Bowker Bank, Crumpsal, one boiler	- - -	Oct. 1817.
Jonathan Pollard, two boilers, 21½ feet long by 5 feet 7 inches wide	- - -	Dec. 1817.
Moore and Welsh, two boilers, 16 feet long by 5 wide	- - -	Jan. 1818.
Benjamin Joule, two boilers	- - -	Feb. 1818.
Ditto - Ditto, three brew pans	- - -	Feb. 1818.
Ditto - Ditto, one boiler, Mill-gate, 18 feet long by 10 feet wide.	- - -	
Moult and Holdens, Bowking Keer	- - -	July 1818.
Blacklock and Appleby, one boiler	- - -	July 1818.
William and George Lomas and Co. one boiler	- - -	Oct. 1818.
Thomas Chadwick, one boiler	- - -	June 1818.
Samuel Matley and Son, one boiler	- - -	Dec. 1818.
John Barge and Co. one boiler, 21 feet long by 6 feet wide	- - -	Jan. 1819.
Holt, Birch and Holt, one boiler	- - -	March 1819.
Richard Gould, two boilers, 22 feet long by 6 feet 6 inches wide	- - -	June 1819:

These two boilers are now doing the same work with greater ease than was done before with three boilers, and one third of coals saved; before the alteration, the consumption was 44 tons 7 cwt. for 76 hours, and is now reduced to 30 tons for 76 hours, which may be seen on reference to my coal account and time book.

N. B. The smoke of the above boilers was in the darkest shades, and complained of as a great nuisance by several of the neighbouring gentlemen.

-- No. 5. --

Appendix,
N^o 5.LETTER from Mr. COOMBS, with Plans and Description of his Inventions for saving
Fuel and suppressing Smoke.

SIR,

66, High Holborn, London, July 2, 1819.

IN submitting my plans to the consideration of the honourable Committee, I beg leave to accompany them with a few remarks, which, although not so clear as I could wish, may still tend to elucidate the operations of the apparatus, and of exciting some ingenious artist to correct the existing evils, such as the immense waste of fuel, the inconsistent plan of erecting as also of feeding the fire of steam and other boilers, the obviation of which inconvenience, has employed much of my time for upwards of ten years back; and although I have succeeded in some points, yet there remains much to be done; and so convinced am I of its practicability, that I have looked with the daily expectation of some engineer producing a plan that would embrace completion. Steam engines are now brought to so high perfection, that there seems nothing scarcely that cannot be performed by them, and I am of opinion they can be made their own servants, to supply their own fuel, and also to consume their smoke, on different plans; and I would remark a powerful drawback, namely, the door in front for feeding the fire, the removal of which I strongly recommend, well knowing its great mischief: every time the door is opened to supply the fire, thousands of gallons of cold air rush in, striking against the bottoms and sides of the boilers, cooling the flues, and most completely counteracting our grand object, of retaining heat, may I say, equal in effect almost to water. The usual method of supplying the boiler with fire, the door is opened every five minutes to admit four shovels of coals; by this method, out of twelve hours, the door is opened three hours, exposing the boiler and flues, which not only impair and damp the fire, but assists much to force up the virtue of the coals unconsumed. Within the bills of mortality, how many thousands of chimnies are at this moment emitting into the atmosphere their black and immense volumes, consisting of the strength and virtue of some hundreds of chaldrons of coals. May not this rouse the thinking mind to exert its energies to an application of this smoke, which is no other than an impure gaseous state of coal? The perfection of gas, and its usefulness, which is nightly before our eyes, convinces me that the smoke of steam and other boilers may be transmuted into fuel, and to a great extent of saving. Steam boilers require a strong heat and power to raise the steam to a certain force at first, then to maintain that force, continuing a solid and steady heat without so strong draft, or, in other words, without the extraordinary waste and consumption of coals. With my drawings and model I will more fully explain it. Brewers coppers I have found much more difficult, as they must not only have a strong boiling heat, but also power to damp their fire with facility; this sudden change they require twice a day. With the power of moving the body of coals from the boiler, I consider we may, and I am emboldened to say, from late experience and observation, it can be accomplished; by igniting smoke we convert it into fuel. To convey an accurate description with my pen I find difficult, but by a verbal explanation, I doubt not to make it evident the great advantage resulting in forcing the smoke through red-hot cylinders, pipes, or flues for ignition, and also in feeding the fire with hoppers and wheels, or perpendicular, or in an oblique direction. That I may be more fully understood, I have given a section of a coke oven, the process of which, has years back convinced me that boilers may be heated on the same principle, and with an extensive saving of time and fuel. Coals, like a corn-field on fire, will communicate its heat and flame from one particle to another, as the currency of air drives it. The arrangement of air into all fires I consider of the utmost consequence, as I am confident, that with care, even our atmospheric air may be considered as fuel. In my specification 1813, I claim the shape of a boiler, standing on an iron pillar at the back; also, on a plate of iron: for small boilers, it answers; but it is the brewers coppers that have baffled my efforts till within these three months. I am prepared for many objections to my drawings and plans, but I wish to observe, that I am as willing to assist as be assisted: and

I remain, Sir,

Your humble and obedient servant,

M. A. Taylor, Esq. M. P.

Benj. Merriman Coombs.

EXPLANATION of Mr. Coombs' Plans for saving Fuel and suppressing Smoke.

Appendix, N° 5.

Plate VI.

Front Elevation, Fig. 1.

- E E. The frame of front door or window opened in a double rabbet, air tight, glazed with talk or Muscovy glass, that resists the strongest heat, and remains transparent; this gives an opportunity of seeing the state of the fire without opening the destructive door that admits thousands of gallons of cold air to cool the bottom of boiler, and also the flues.
- F. The sloping grating, or bars, for admission of air.
- G G. The handles of the raker to stoke the fire, and also to force back the cinders and clinkers into a chamber; thus the fire is stoked with the door shut.
- I. The top of boiler.

Side Elevation, Fig. 2.

- E. Front door or window.
- F. The sloping bars inside of the brick-work.
- H. The aperture for air to pass between two walls, or plates of iron.
- J. The register, or damper.

Section through A B.—Fig. 3.

- I. The boiler.
- O. The fuel-hopper, fixed to the ceiling of the coal-room, in an elevated state, and united to P, a leather or metal channel, to convey coals through the brick-work; this communication may be either in front or sides of the fire.
- N N N. A mass of cast-iron to receive the first heat, with the small aperture S. The flame rushing up S not only ignites, but unites with the general draft and the internal flue K.
- M M M. Welsh lumps, or pipes of iron, which receive the direct heat of the fire and ignites the passing smoke.
- R R. The back apertures of ditto.
- G. The worm-screw, rack, or any power to raise the coals, as the consumption requires.
- Q. The cylinder, or the receptacle for coals.
- T T. The bottom plate of iron to convey the fire *up* or *down*, which will prove a great advantage to brewers and others, who require the power to damp their fire three or four times a day; by lowering the fire, and opening the door or window, the cold air rushes in, and acts almost equal to cold water against the boiler and flues; and with the same power and facility, the fire can be increased.

Section through C D.—Fig. 4.

- I. The boiler.
- K. The internal flue, as fig. 3.
- L L. The return, or side-flues.
- M. The pipes, or Welsh lumps, for ignition, as fig. 3.
- H H. The side apertures for admittance of air, by passing between two walls or plates of iron, become heated to a great extent, and keeping the external walls cool, the immense heat that is so universally lost in the mass of brick-work, is by this means forced back into the fire, as a substitute for fuel; the furnace is surrounded by a currency of air.
- G & Q. As fig. 3.

Plan, Fig. 5.

H & I. As fig. 4.

Sectional Plan, Fig. 6.

H I K & L. As fig. 4.

Fig. 7.

The hopper, with rollers, round or square, to break the coals, and admit into the fire a regular supply, that the smoke may be transmuted into flame as it falls on the fire, keeping a bright and clear fire, with the assistance of the stoker, as it is consumed, to send it into the chamber, as Plate VII.

B. M. Coombs, 66, High Holborn.

Appendix,
No 6.DESCRIPTIVE Reference and Explanation of Mr. Coombs' Steam Boiler, Furnace, and
Coke Oven.

Plate VII.

Fig. 1.

- A. The fuel-hopper, to convey the coals into the front or side of the fire.
- B B B. Three iron rollers, to reduce the coals, and supply the fire as consumption requires.
- C. The front grating, and only aperture for air; the coals being always above the front bars, the air must pass through the fire and become heated.
- D D D. Massive lump of iron, with a return end, to receive the first heat; and M, the small aperture for flame to pass, to assist and ignite the smoke, if any, that passes through the internal flue E.
- F. The bottom of boiler.
- G. The boiler-head.
- H H. The back flue through the iron cylinder, cast in four, eight, or twelve pieces. If any part burns out, it may with ease be replaced.
- I I I I. The substance of metal.
- P. The damper or register.
- R. The cinder-receiver, or ash-pit.
- S. The door, with double rabbets, air tight.
- K. The man-hole, for cleansing the internal flue.

Fig. 2.

- N. End view of the boiler.
- E F G. As above.

Fig. 3.—Section of Coke Oven.

Coke ovens are too well known to require an explanation. This section is only given to convey a correct idea, and proving, that by lighting the fire at B, the flame glides along the top, and ignites the coals from B to C and D, up the flue F, then burns down from F, to G, and from H to I; by this mode three or four chaldrons of coals are burnt without smoke. As the boilers cannot be brought down to H and I, it would be easy to raise H and I to B and D, as the consumption of fuel requires, and always maintaining a steady, clear and bright fire, with little or no smoke: by this plan the fire can be kept at any distance from the boiler.

- A. Iron plate made to slide, for admitting air as the fire burns down.

— No 6. —

Appendix,
N^o 6.EXPLANATION of Patent Smoke burning Plans and Apparatus; referred to in
Mr. BRUNTON's Evidence, p. 13.

Plate VIII.

Fig. 1, 2, 3.

- A. Revolving grate. *a*. Lining of fire-brick.
 B C. Supplementary boiler. *b*. Aperture for coal. *c*. Fire-door.
 D. Feeding-box and roller.
 F. Hopper for the coal.
 G. Brick flue by the end of boiler H, to which the apparatus is applied.
d d. An iron flue, if necessary, to save room of the brick one.
 J. Water-wheel. *e*. Cock for regulating the water.
f g h. Shaft and wheels, by which motion is communicated to the feed-roller and grate.
 K. Doors for the admission of atmospheric air, to burn the smoke.

Fig. 4.

- L. Revolving plate for the ashes.
k. Sweep for ashes.
 M. Ash-pan.

Fig. 5 and 6.

The application of a revolving grate to a high pressure boiler.

- N. Two tubes connected to the boiler by the curved pipe *l*.
 O. Diagram of the hopper and feeding-box.
m. The aperture between the tubes for the admission of coal.

AS explanatory of the means by which the effects stated in my Evidence are produced, the annexed Drawing (see Plate VIII.) has been made, which is similar to the Model I have had the honour of exhibiting to the Committee, and to the Grate now in use at the Eagle Foundry, Birmingham.

THE grate A, which is round and having a rim of fire-brick, is supported upon an upright spindle, and moved round by the power of the engine, or by a small stream of water falling upon the water-wheel J. Revolving grate moved by the engine, &c.

The supplementary boiler B C, is constructed in a great measure to inclose the grate, and has an aperture *b* through the top of it, through which the coal falls upon the grate; when this apparatus is connected to a boiler already at work, the supplementary boiler is connected to it by corresponding holes in each, to admit the water, and also by the connecting pipe shown by the dotted lines in figs. 1. 2. Supplementary boiler is connected to the engine boiler by corresponding holes.

Upon the top of the supplementary boiler, covering the aperture for the coal, a square box D is placed, containing a roller with teeth, by turning which the coal is discharged from the hopper upon the grate, in any quantity per minute that may be required, and in such a manner as to distribute it equally thick upon the surface of the grate as it turns round. This roller is also turned round by the engine, or water-wheel, by a simple application of wheel-work. Feeding-box and roller. Moved by the engine, &c.

The water for working the water-wheel may be raised by the engine, or by any other means; the cock, through which the water is discharged upon the wheel, is regulated by the damper-regulator commonly in use, so that when the steam is high, the discharge of water on the wheel is diminished, and consequently the speed of the grate and the introduction of the coal are also diminished. When the steam is low, the contrary effects are produced: by this means the coal is introduced upon the fire in such portions as the performance of the engine demands. When it is convenient to apply the power of the engine immediately to turn the apparatus without the water-wheel, the same effects may be produced. Regulated by the pressure of the steam; and may be accomplished without the water-wheel, when more convenient.

The hopper is made large enough to hold coals sufficient for the consumption of several hours. Hopper for the coal.

Appendix,
N^o 6.

The smoke passing over the hot fire, combined with atmospheric air, is consumed.

Economy.

Regular thickness of fire; quantity regulated.

No excess of cold air admitted.

Uniformity of temperature.

Labour saved.

No need to stir the fire; and the coal more completely consumed.

Grate requires less attention; fire-bars last longer.

Saving of labour.

May stand in less space than is represented in the drawing.

It has already been explained how the coal is laid upon the fire in small quantities at short intervals of time; and it will be obvious, upon inspection of the drawing, that the coal always falls upon that part of the grate opposite to the flue, so that the smoke in passing towards the chimney, must go over the grate where the fire is in the highest ignition. That the combustion of the smoke may be effected, atmospheric air is admitted by the doors K, which are easily regulated, as the quantity necessary for that purpose will be nearly alike at all times; or the apertures may be regulated by the same means that regulate the water upon the water-wheel, and thus render the admission of air and coal proportionate.

The economy of the apparatus will appear from the following considerations.

That the coal is laid upon the grate in the most regular manner, and by self-adjustment the quantity at all times is proportioned to the work performed.

The fire-door is never opened, consequently the boiler is not exposed to the chilling effects of cold air, which, in the usual construction of furnaces, is unavoidable, and by which the boilers are much injured.

The boiler is always kept at nearly the same degree of temperature.

The labour of a man is, in a great measure, saved.

There is no occasion at any time to stir the fire, as the whole effect of that process is perfectly attained by the revolving of the grate, and the consequent exposure of all the sides of the pieces of coal to the action of the fire, by which, also, the coal is much more perfectly consumed than by the usual mode of furnaces.

There is much less vitrified cinder formed upon the grate (commonly called clinkers) than is produced in the common furnace; the fire, of course, needs less cleaning, and the fire-bars wear longer.

The ashes falling upon the plate L, are thereby carried round and swept into the pan M, by the excentric bar *k*, in which they may be raised by a crane, and discharged into a cart or barrow without shovelling.

I beg leave to observe, that where the room is of importance, the brick flue G may be dispensed with, by inserting into the boiler an iron flue, as per dotted line *d d*; the whole apparatus would thereby be brought to occupy nearly the same space as is usually occupied by the common grate.

William Brunton.

Appendix, No. 7.

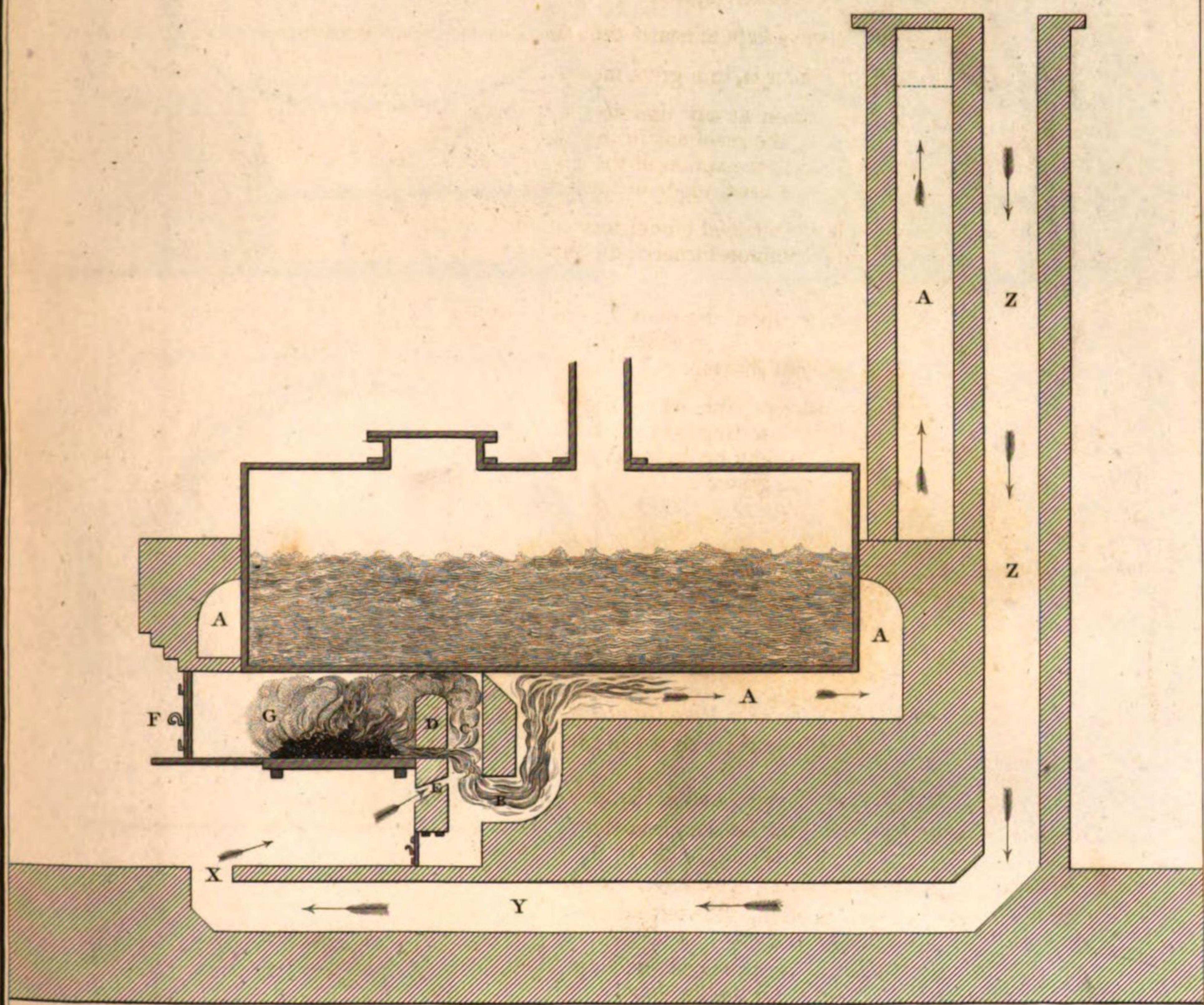
Plate IX.

— No. 7. —

EXPLANATION of a Plan for erecting Steam Engines and Furnaces to consume their own Smoke; referred to in Mr. JOHN WALKER's Evidence, p. 9.

- A. Section, showing end of boiler and descending flue.
- B. Longitudinal section, showing flues with communication to the chimney, and horizontal flues to the under fire-bars.
- C. Plan, showing fire-bars, and top flue communicating to the chimney.
- D. Front section, showing double flues, and end of the horizontal flue under the fire-bars.
- E. Plan, showing the coke-oven, and the under flue which descends to the horizontal flue under the fire-bars.

Gregson's Patent Smoke-consuming Furnace.



M. Losh's Plan for consuming Smoke from Furnaces.

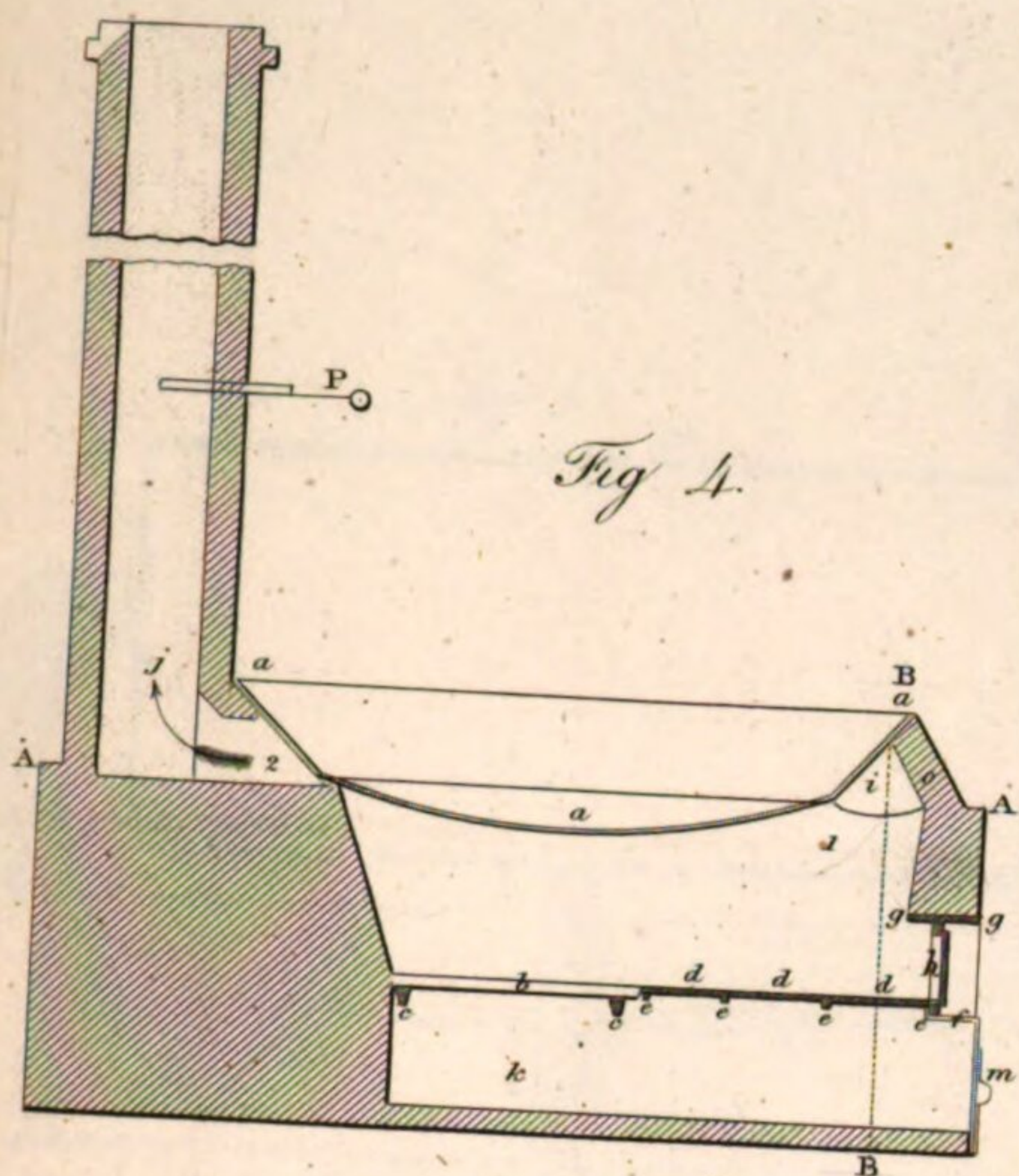


Fig. 4.

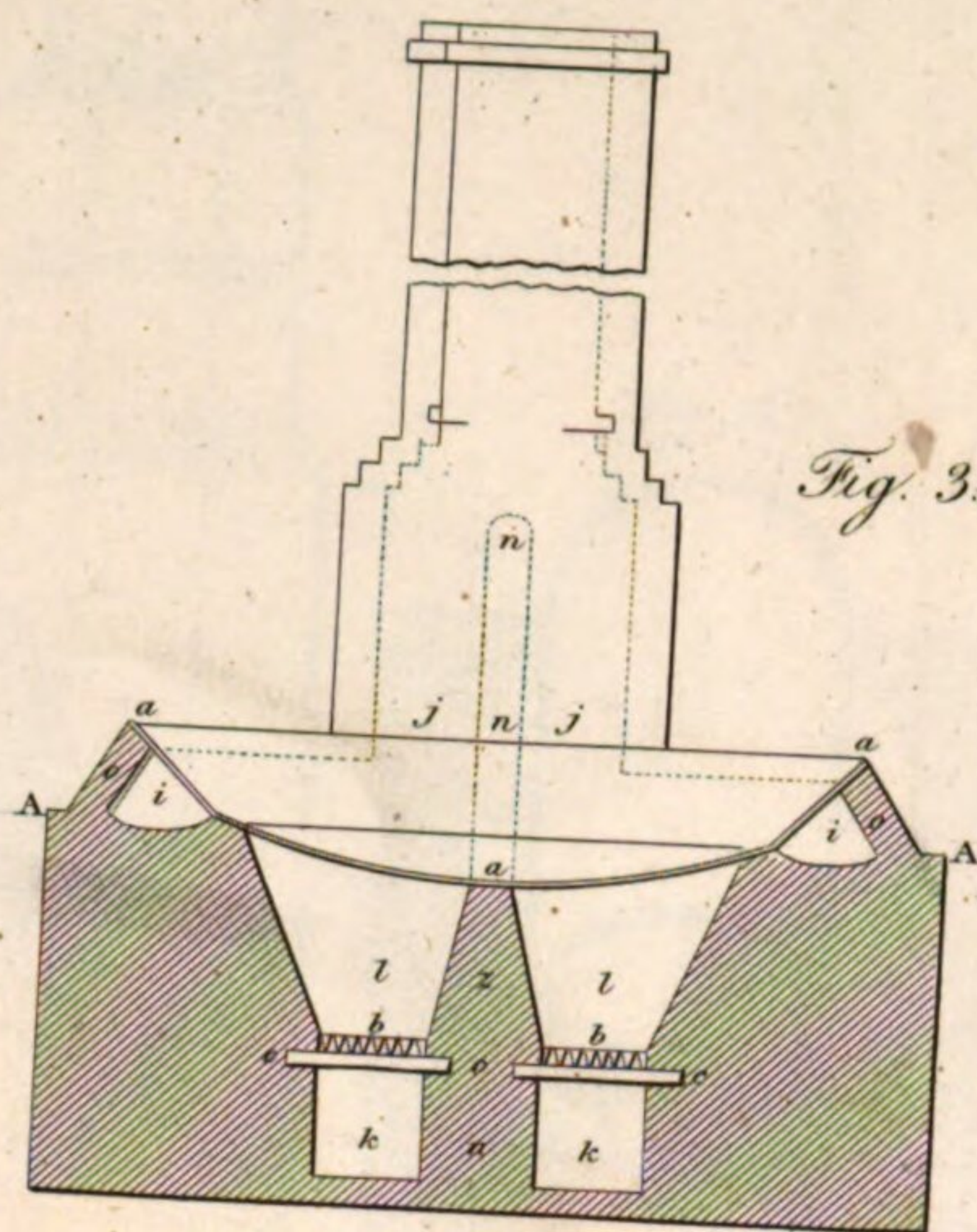


Fig. 3.

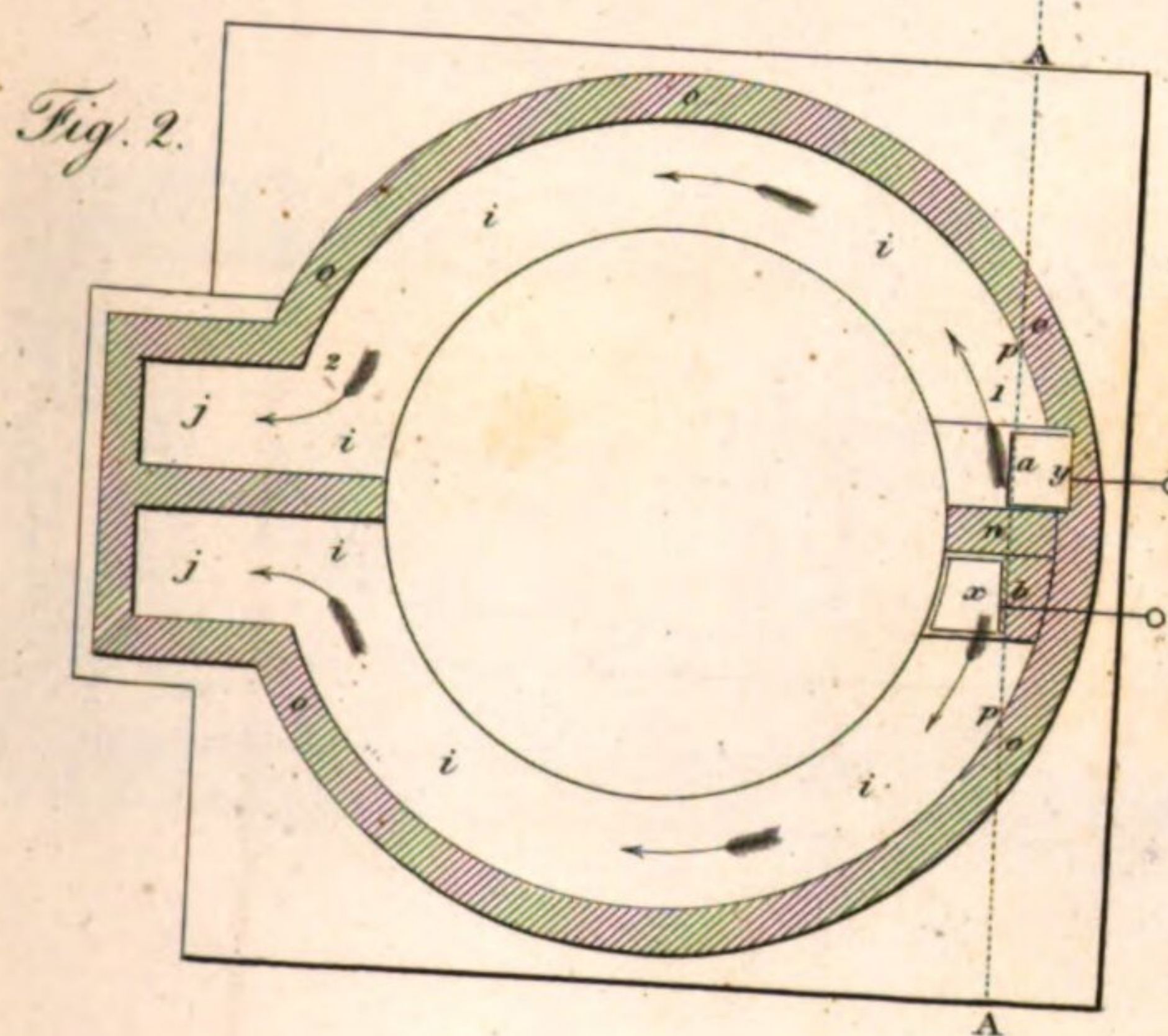


Fig. 2.

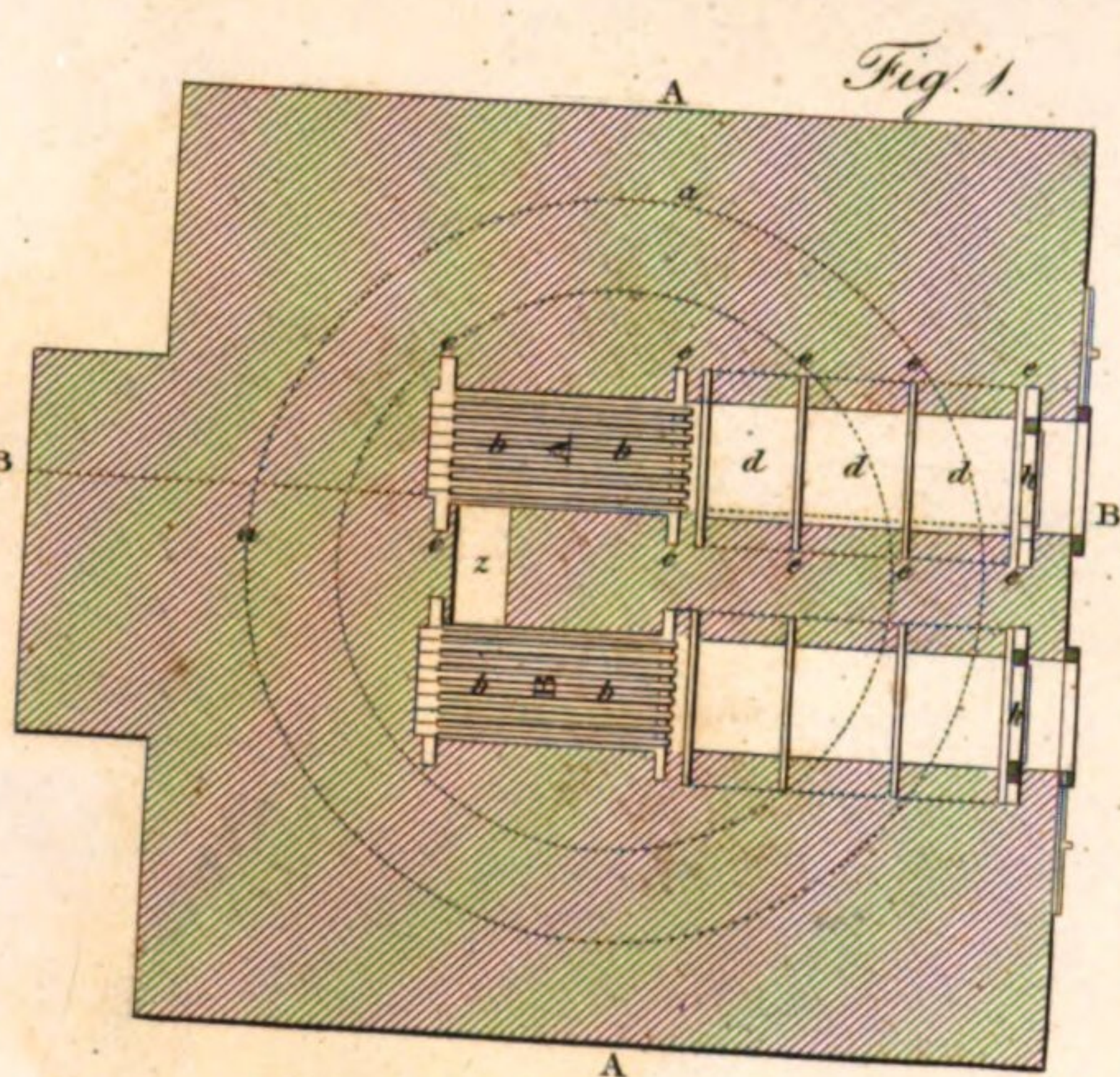


Fig. 1.

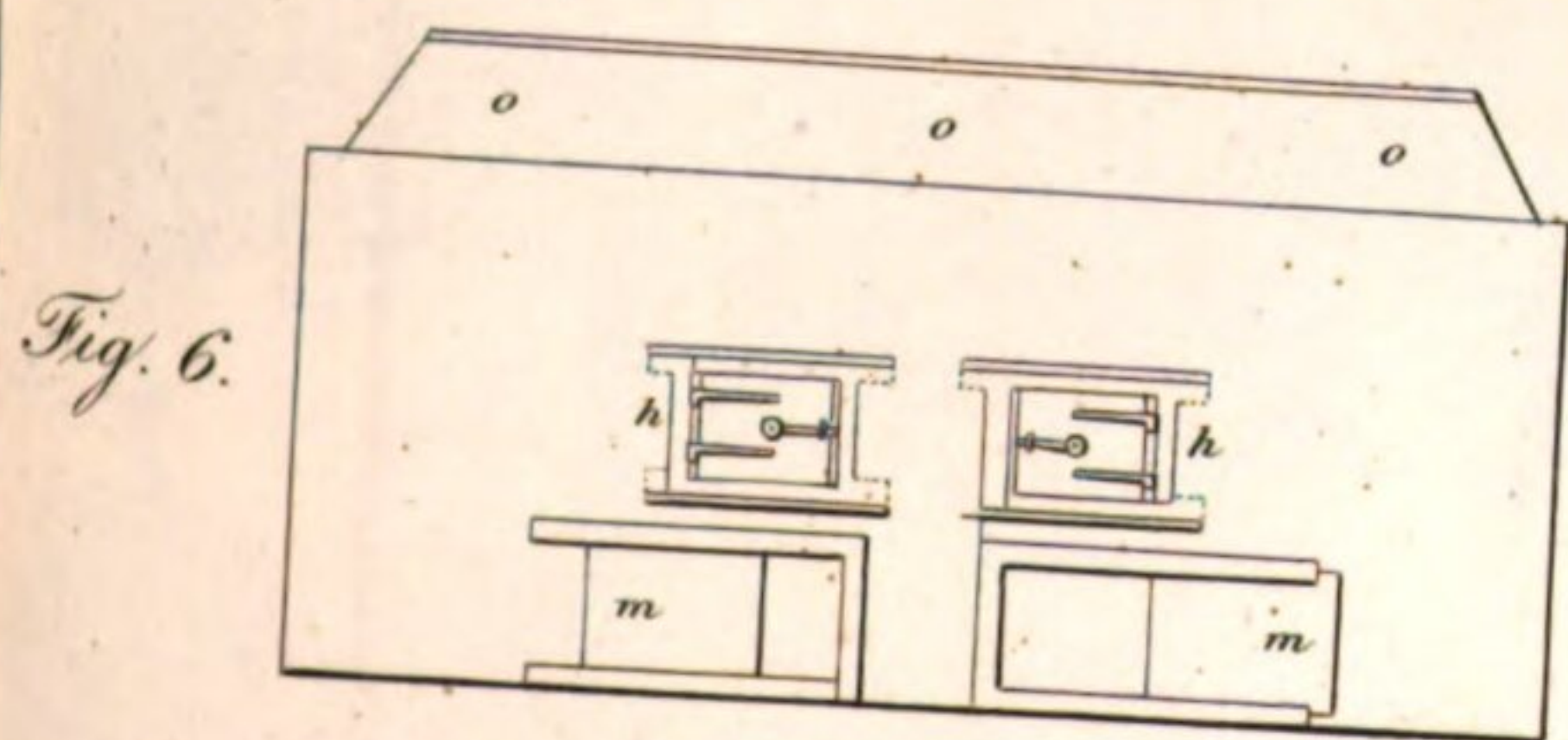


Fig. 6.

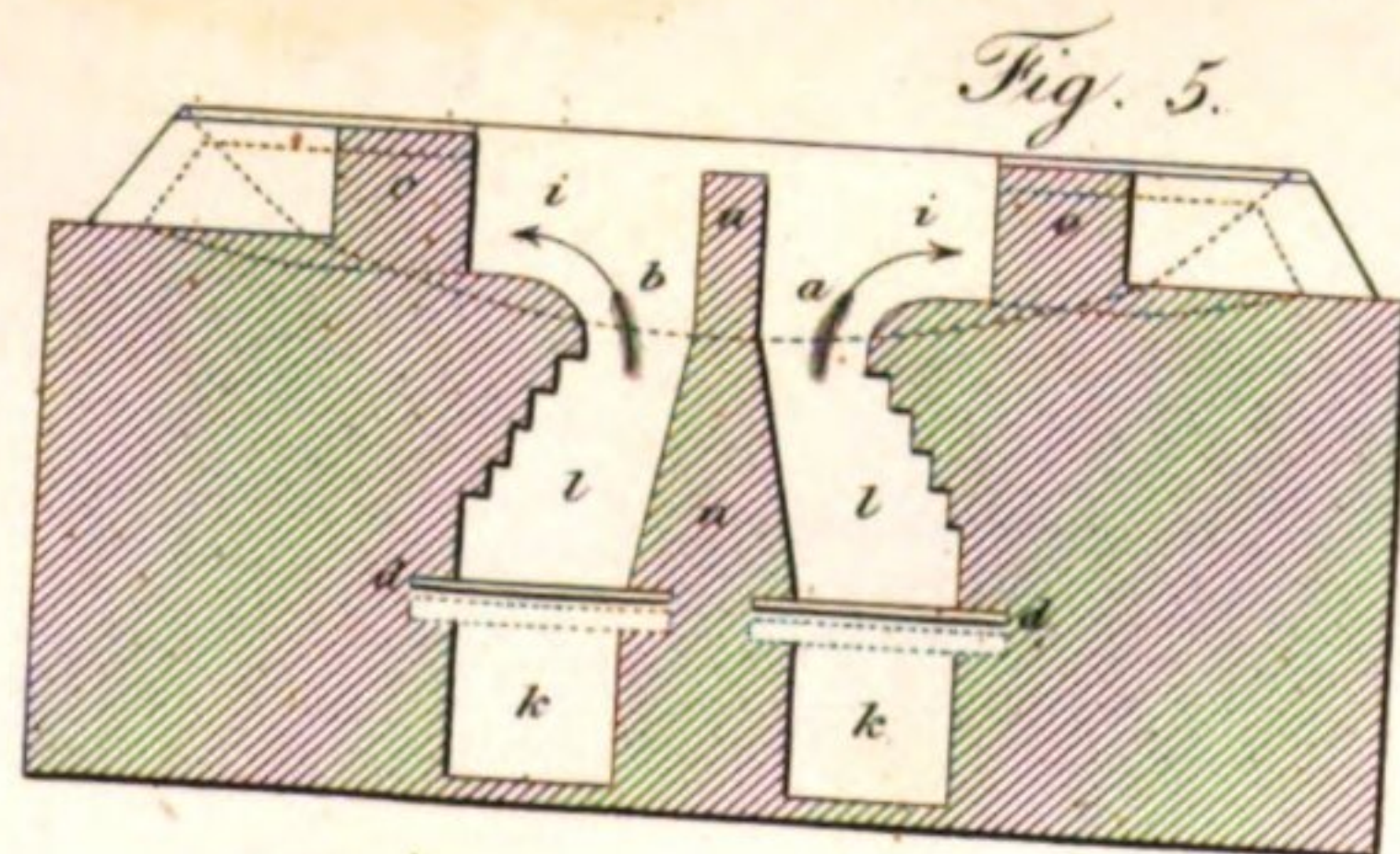
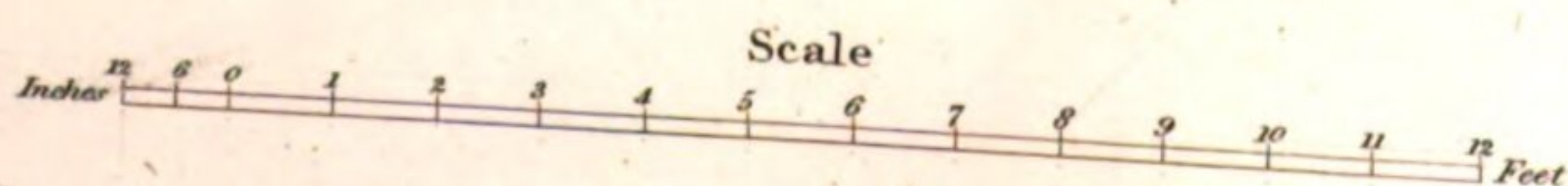
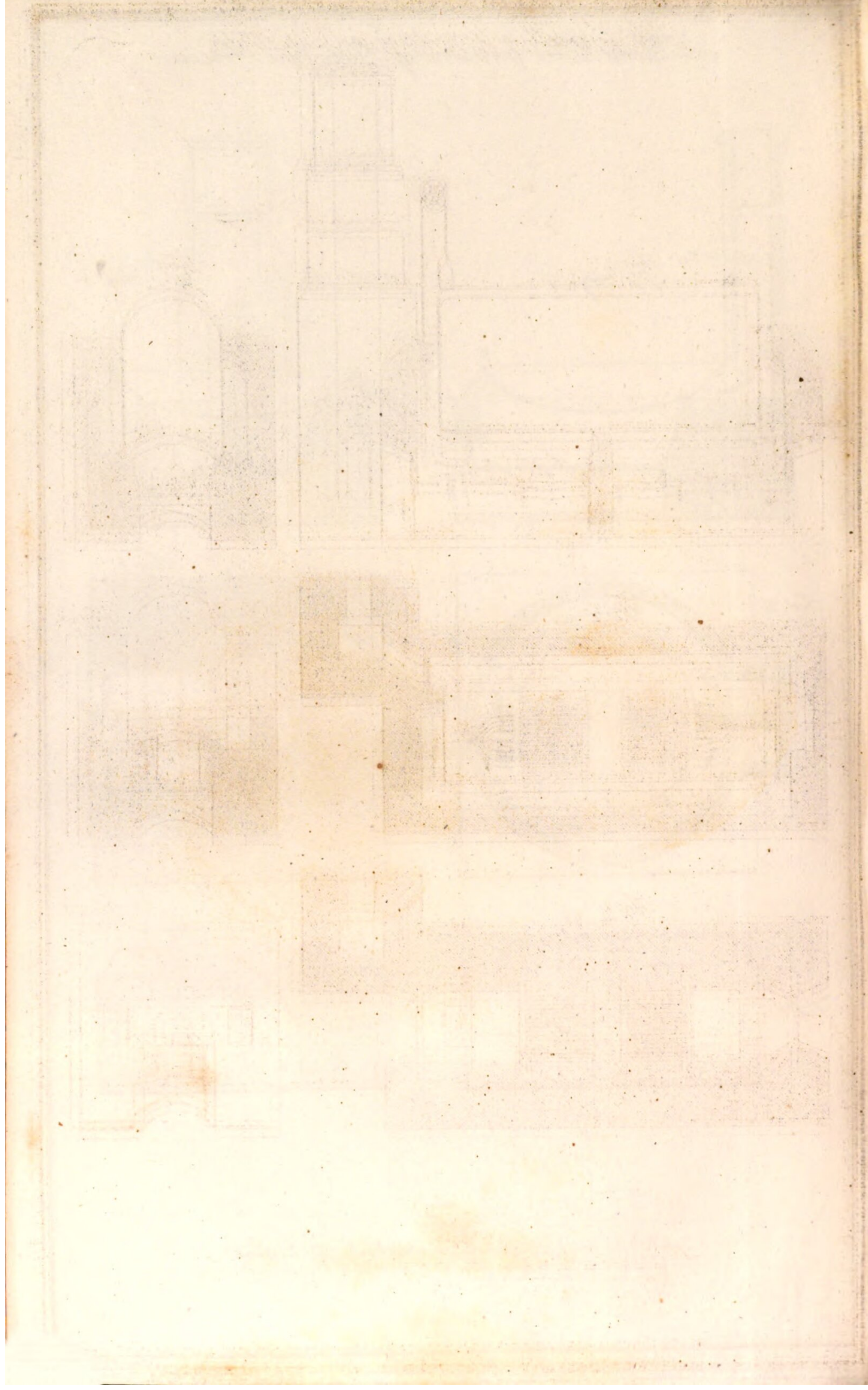
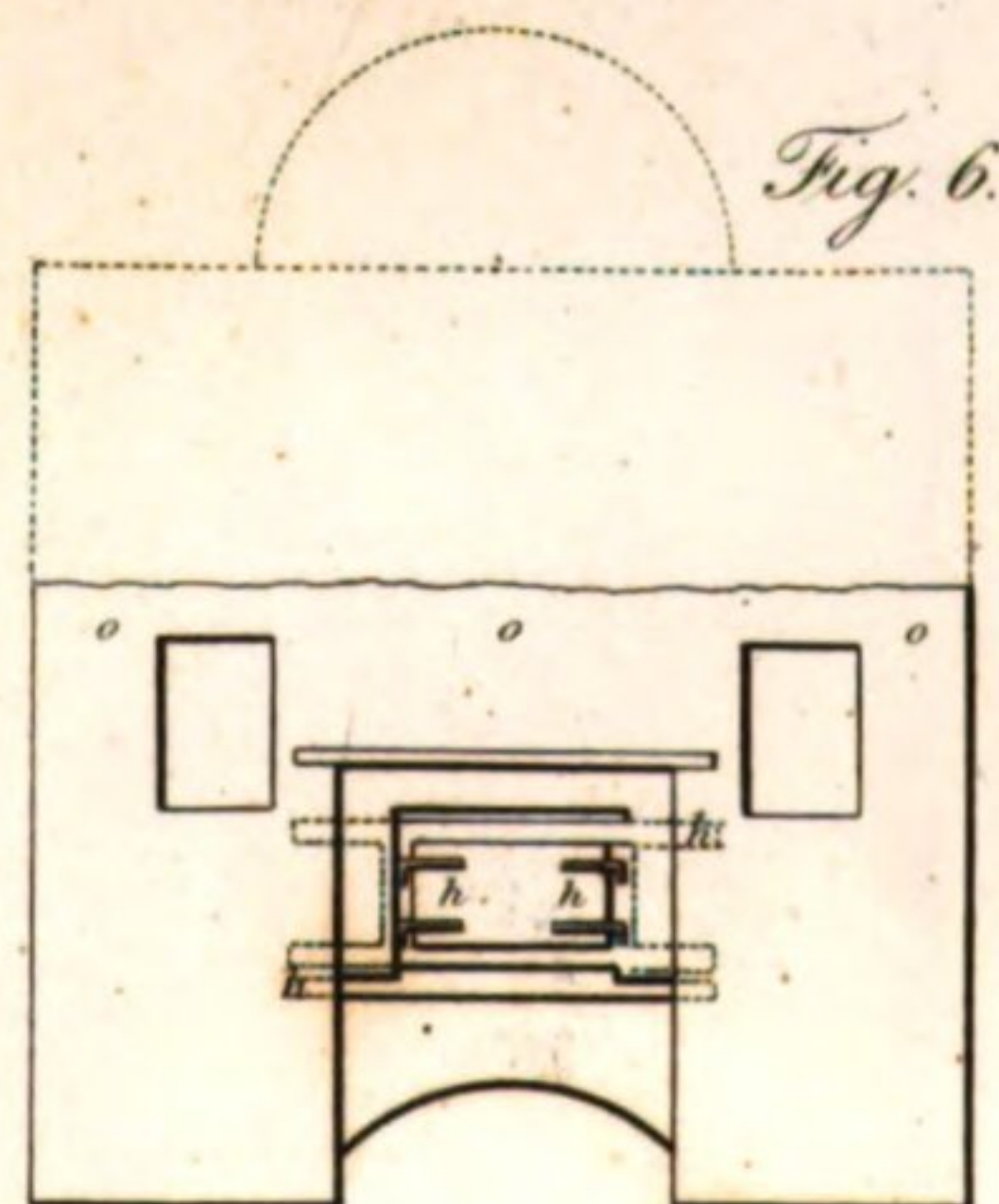
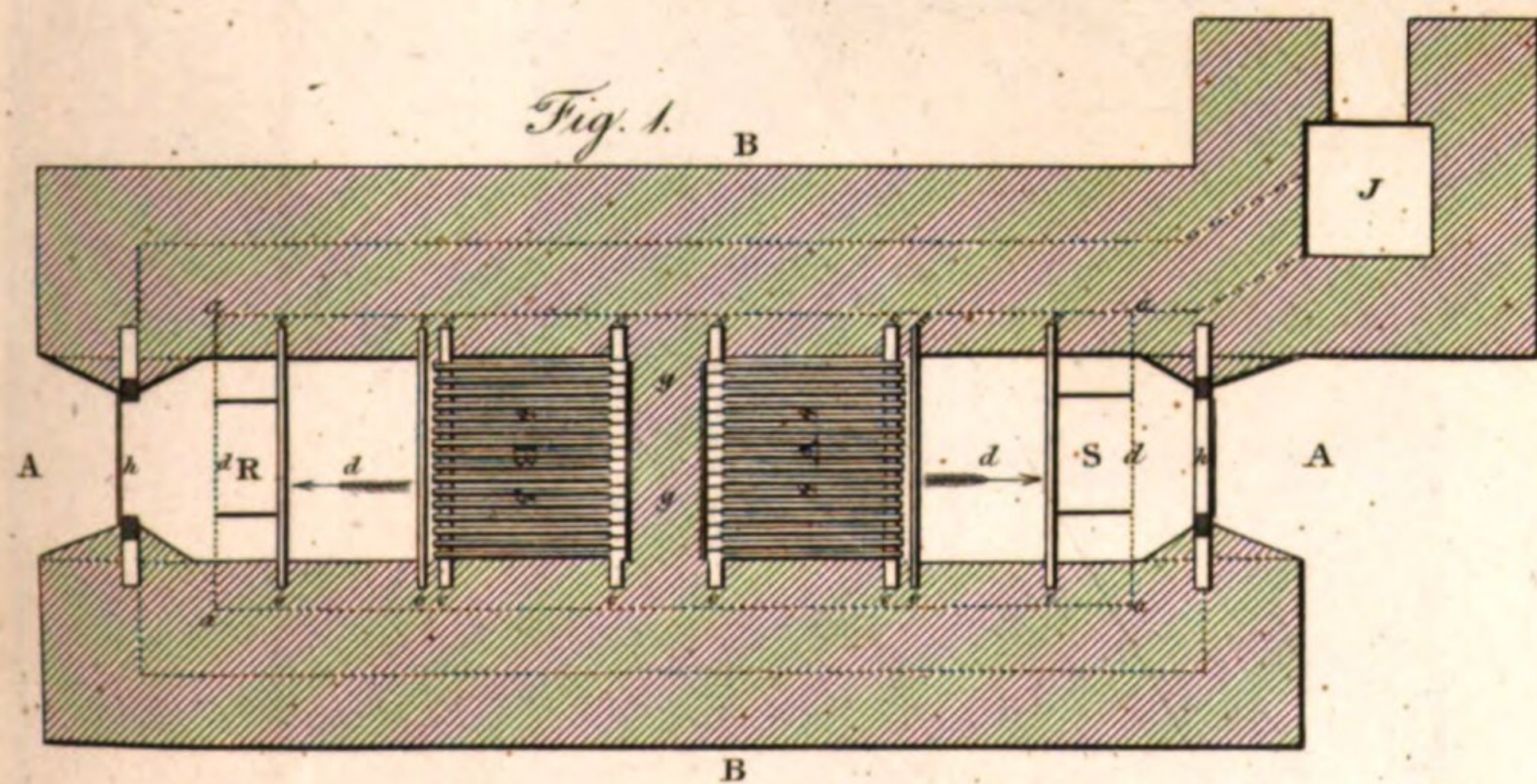
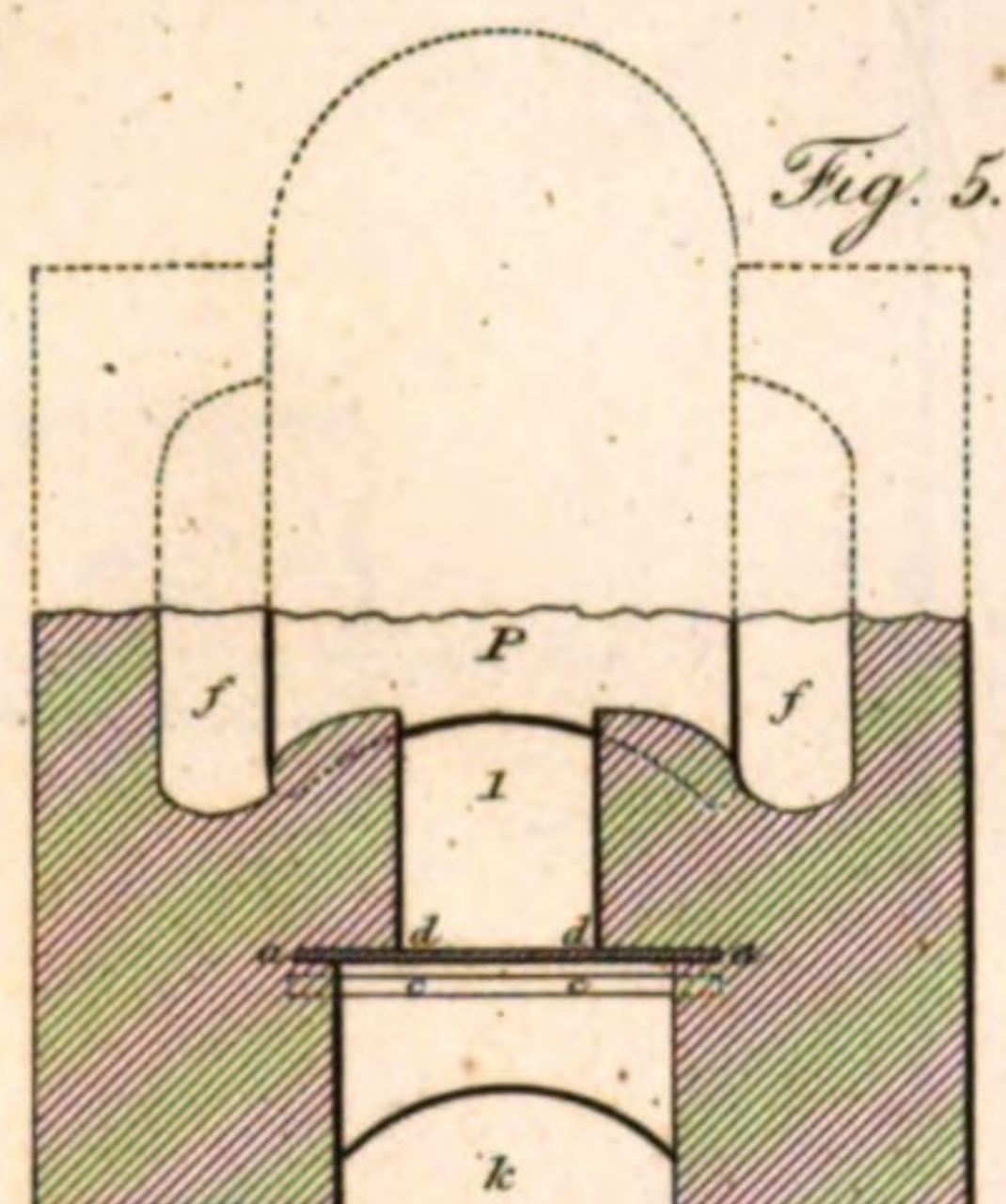
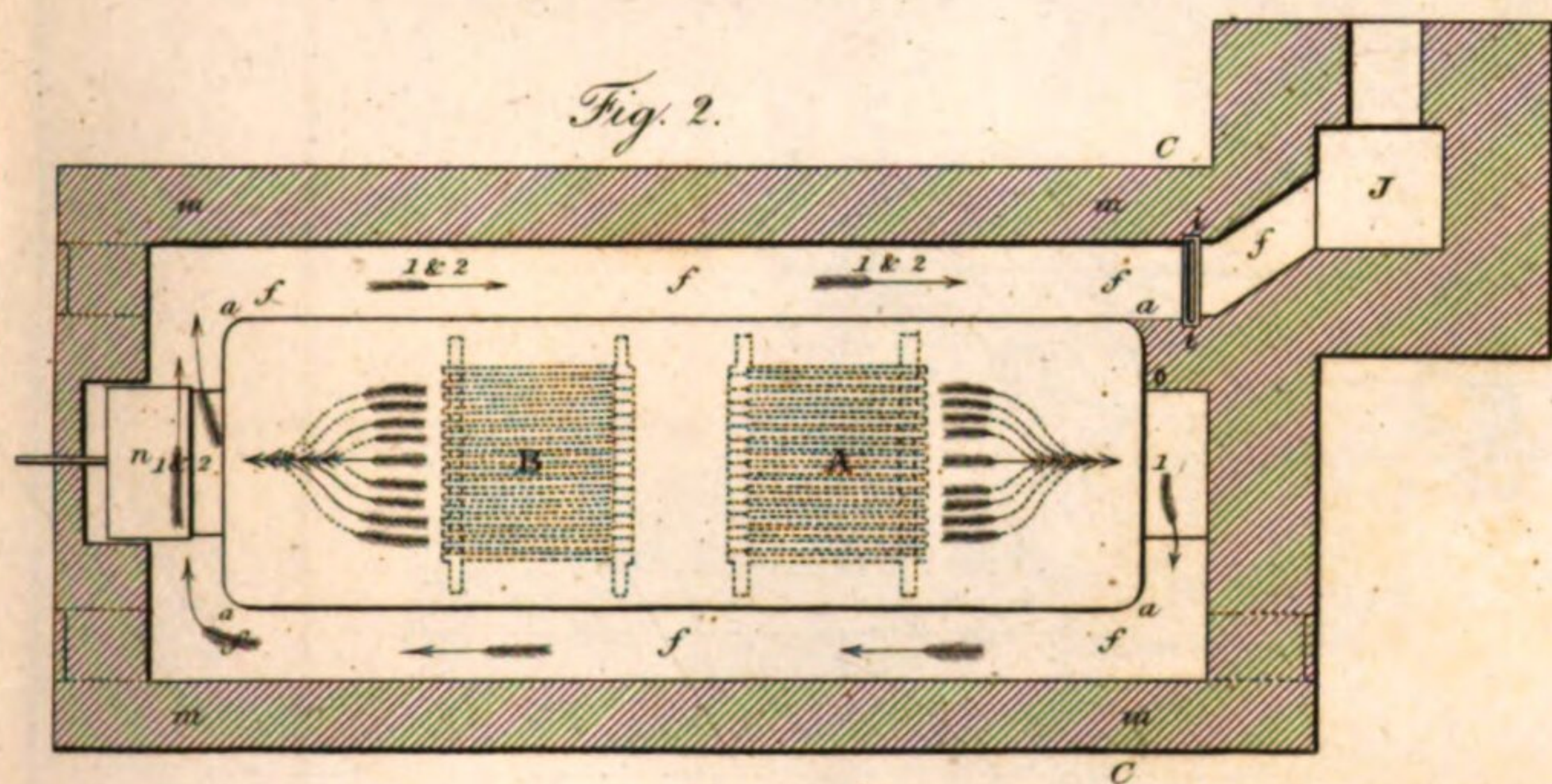
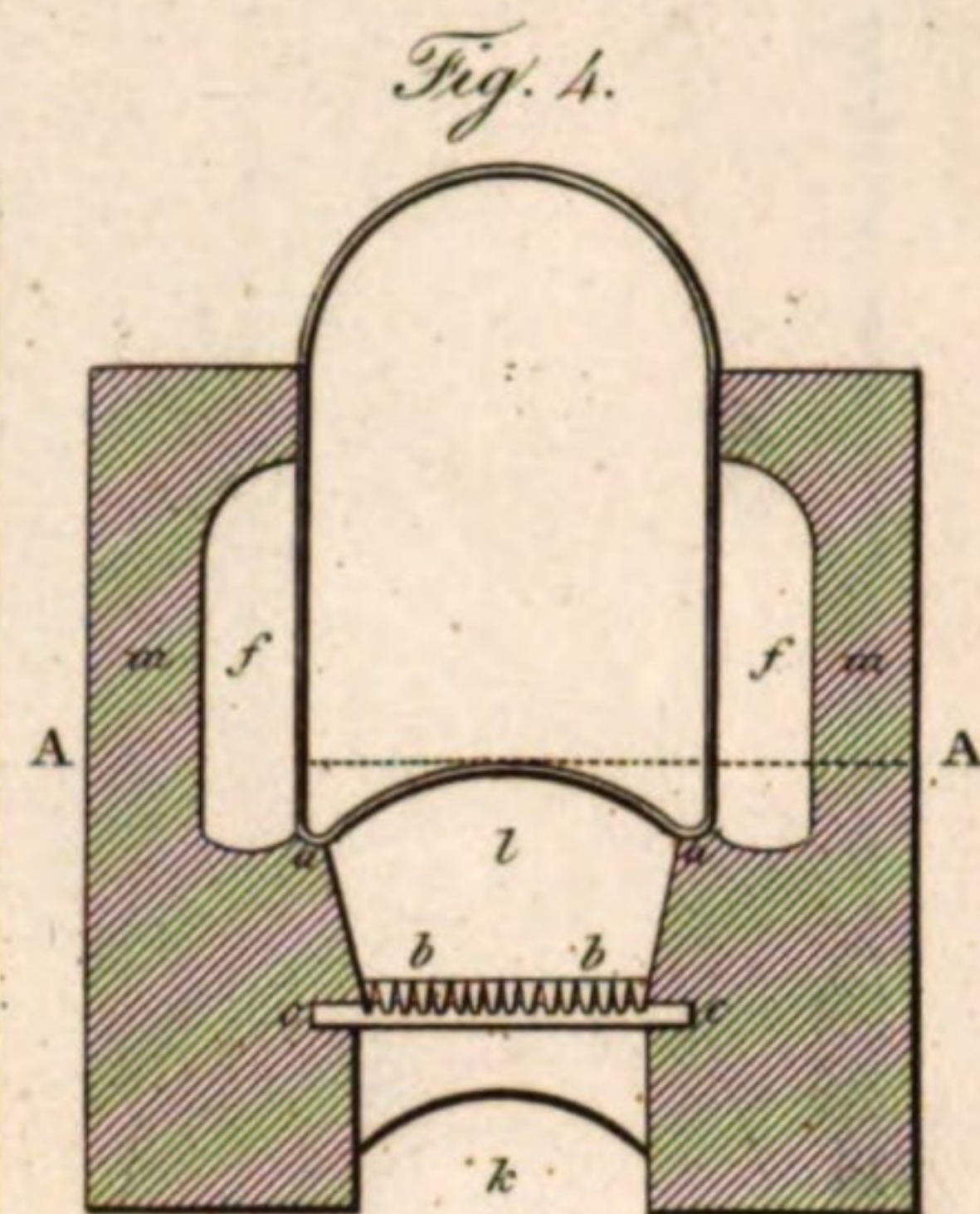
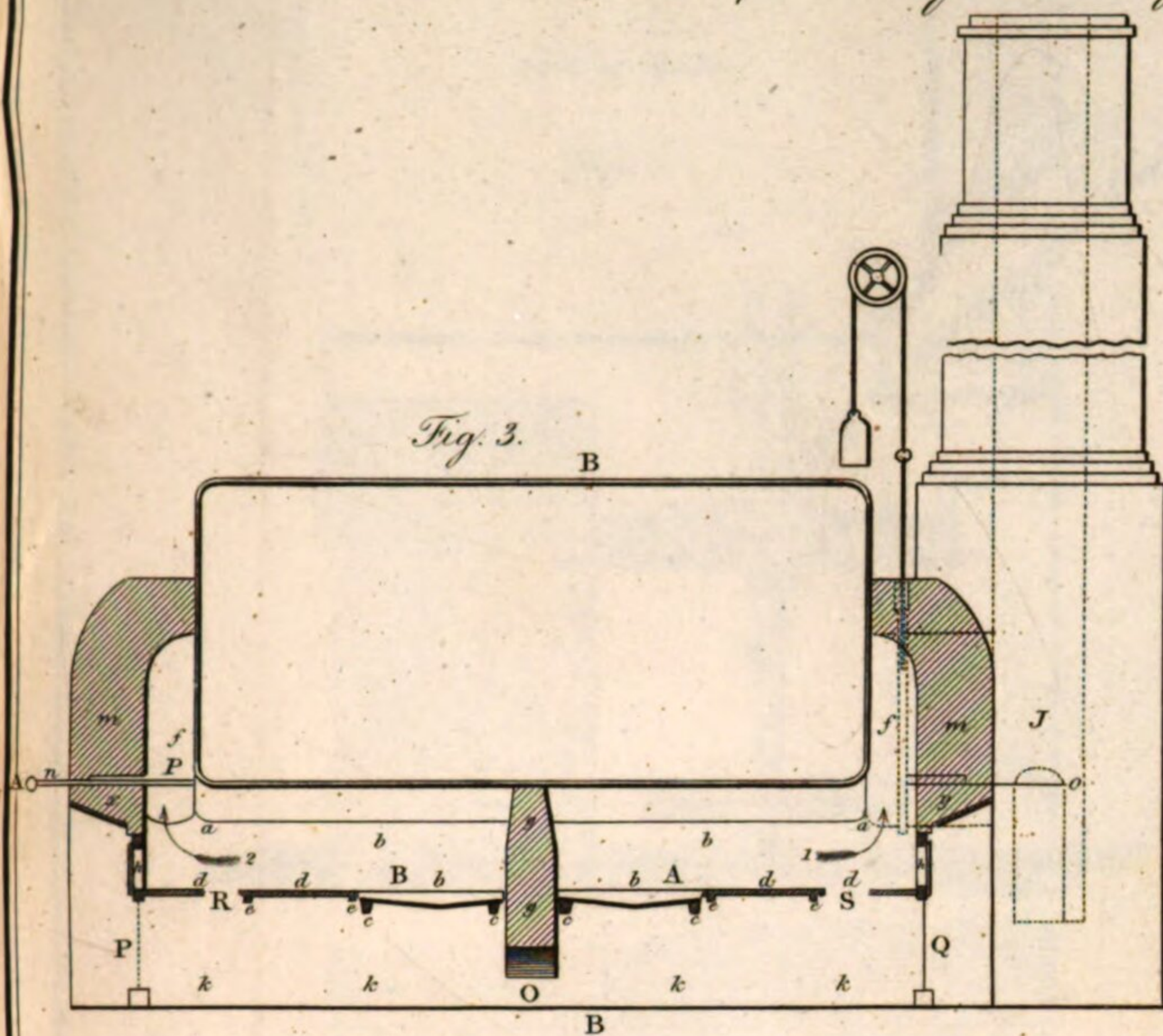


Fig. 5.



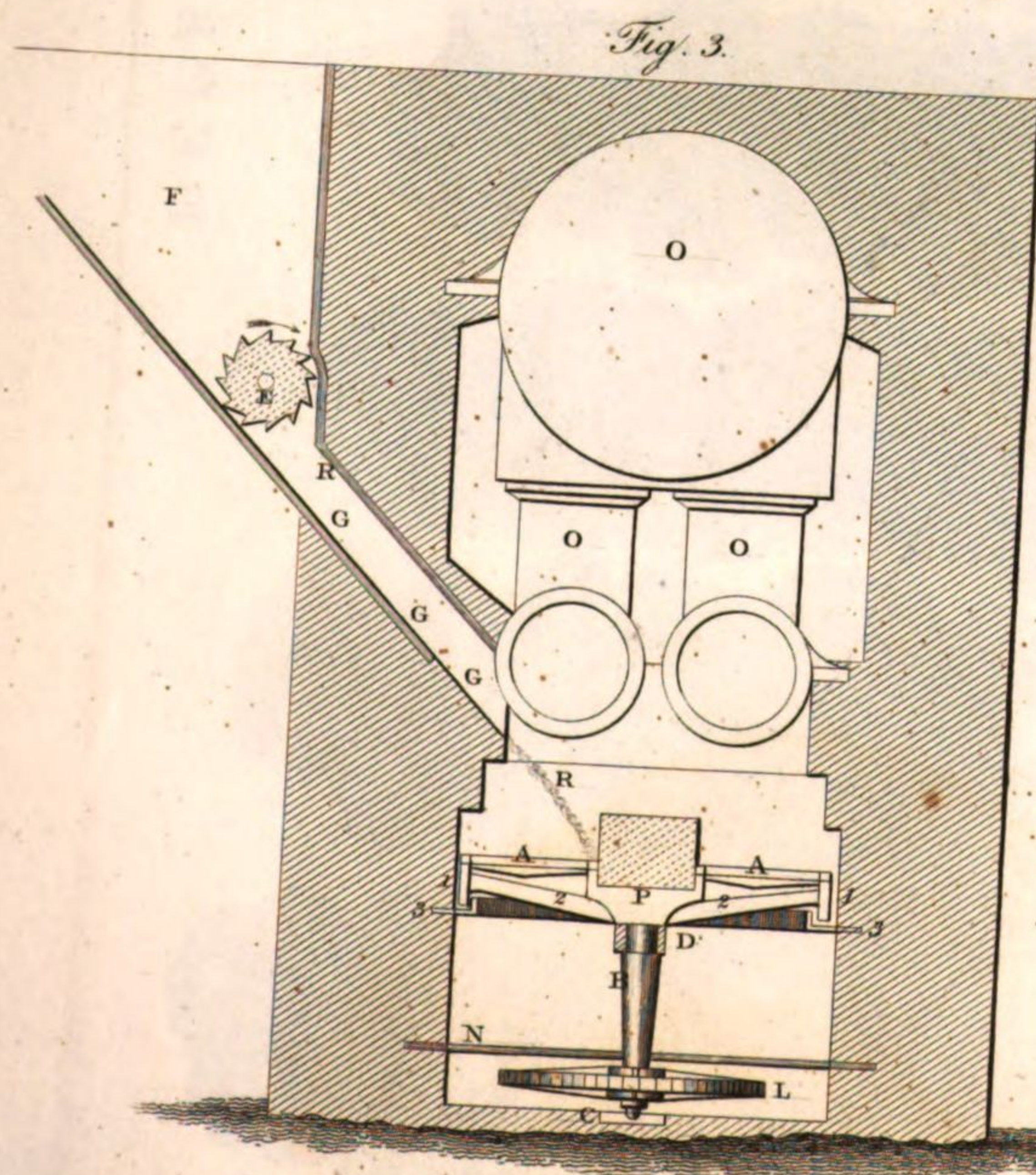
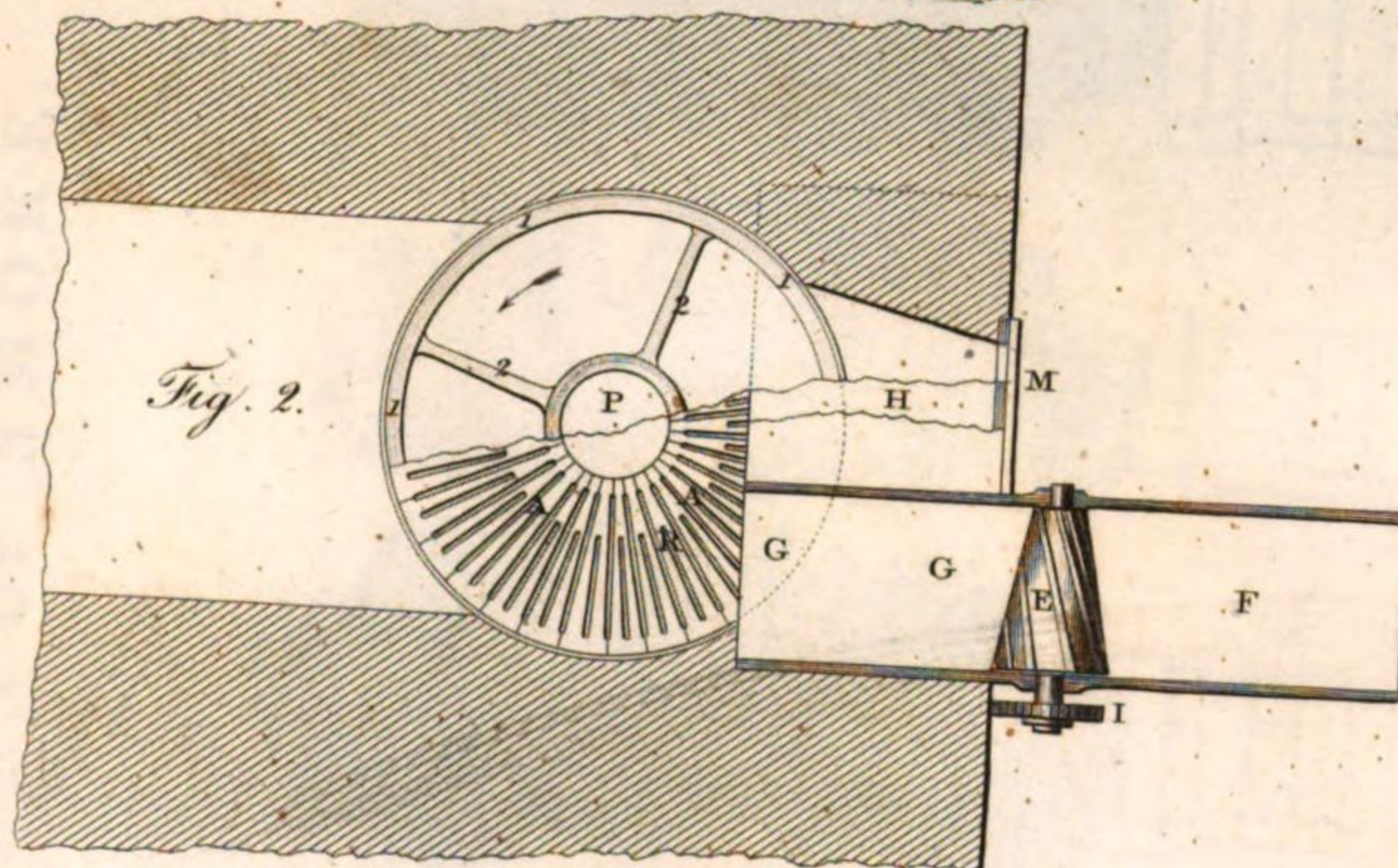
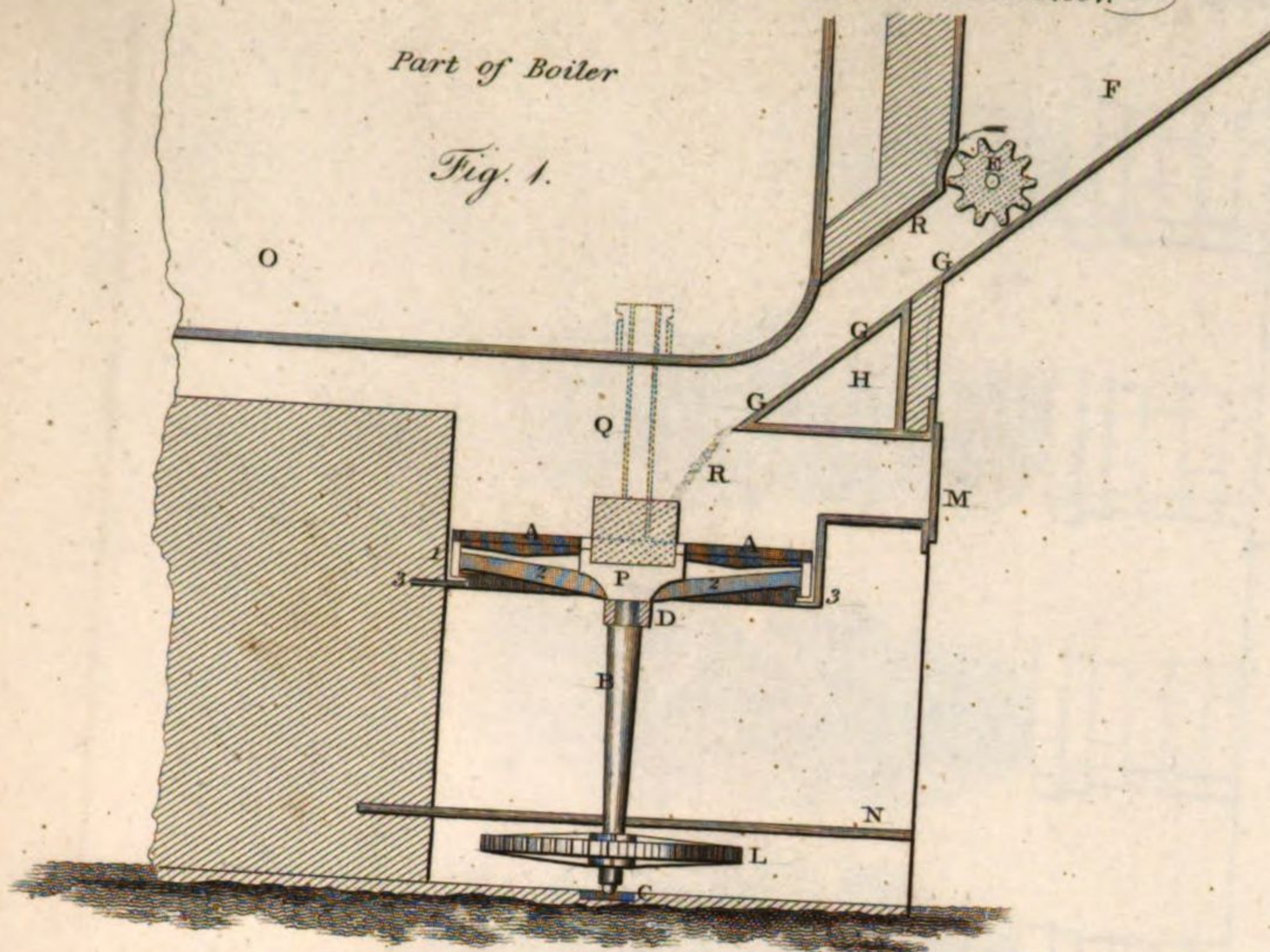


W. Losh's Plan for heating an Oblong Boiler.



Scale.

Inches 12 6 0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 Feet



In. Steel, Dartford

1871

1871

1871

DEGREES OF SMOKE.



Quantity of Smoke produced upon the usual mode of erecting **BOILERS &c.**

*J. Wakefield's
Improvement.*

Front

rollers

Section thro' A.B.

Fig. 3.

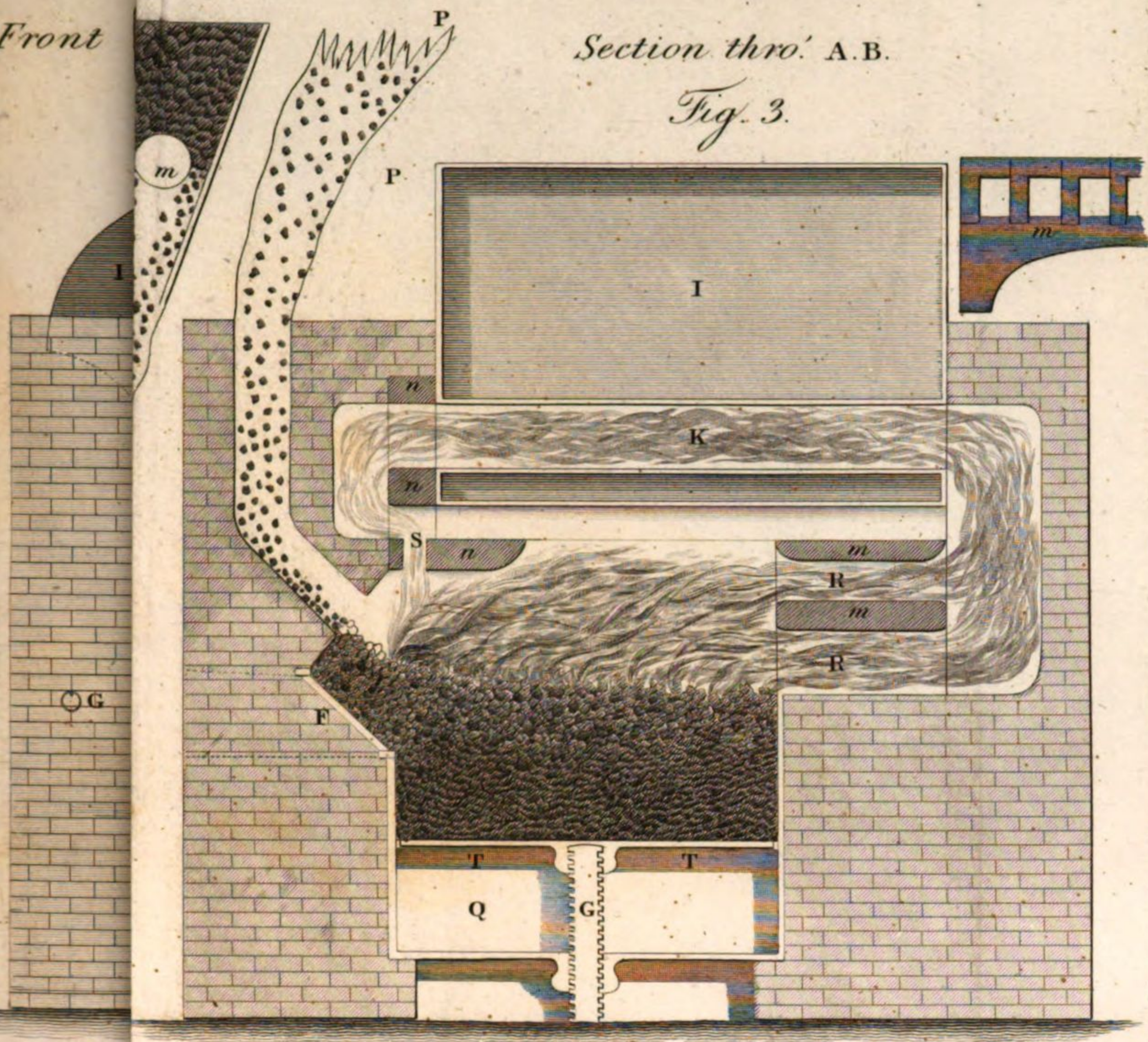
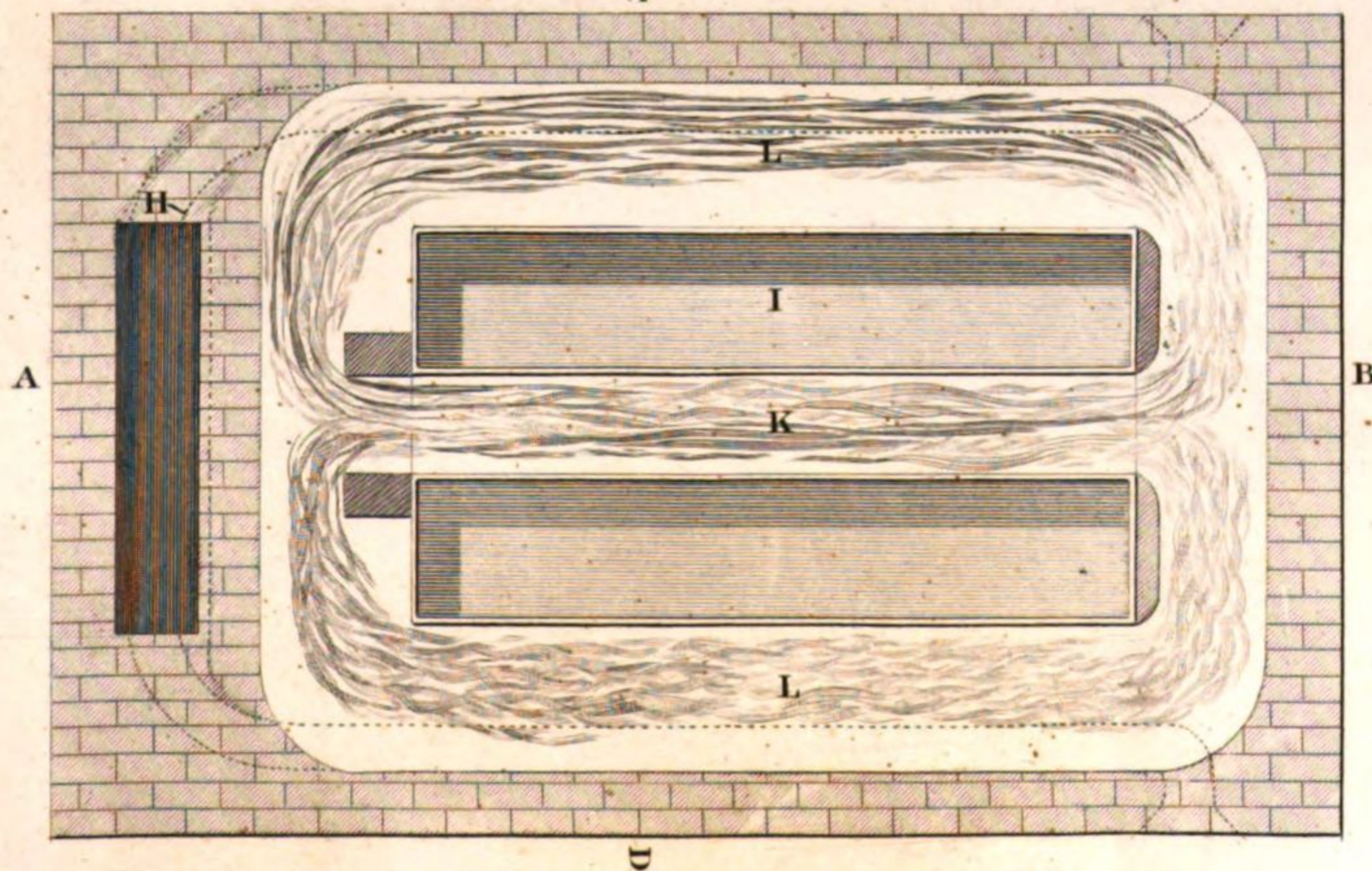


Fig. 4.

and suppressing Smoke

Sectional Plan

Fig. 6.



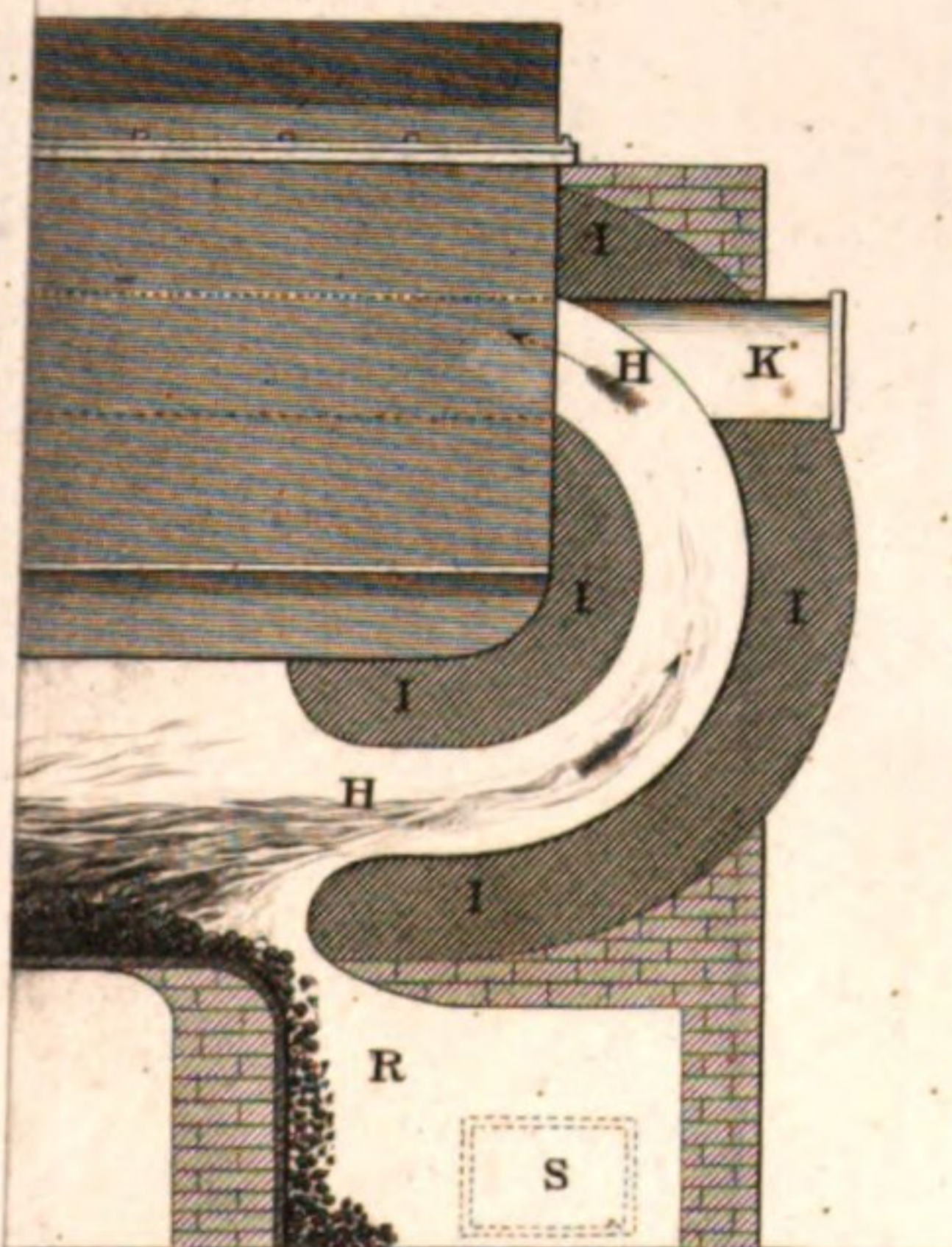
25

30 Feet.

July 1819.

James Basire, sculp.
Luke Hansard & Sons, Printers.

g Smoke.



*Benj.ⁿ Merriman Coombs
66, High Holborn*

R E P O R T

FROM THE

SELECT COMMITTEE

ON

STEAM ENGINES AND FURNACES:

&c.

Ordered, by The House of Commons, to be Printed,
5 July 1820.

R E P O R T

OF THE

SELECT COMMITTEE

THE REPORT	- - - - -	p. 3.
APPENDIX;— <i>viz.</i> MINUTES OF EVIDENCE	- - - - -	p. 5.

STEAM ENGINES AND FERRARIS

Ordered by The House of Commons to be printed
5 Aug. 1830.

R E P O R T.

THE SELECT COMMITTEE appointed to inquire how far it may be practicable to compel Persons using **STEAM ENGINES** and **FURNACES** in their different Works, to erect them in a manner less prejudicial to Public health and Public comfort; and to report their Observations thereupon to the House;—**HAVE**, pursuant to the Order of the House, examined the Matters to them referred; and have agreed to the following **R E P O R T**:

THE Revival of Your Committee has afforded a full opportunity of ascertaining how far the reduction of Smoke in furnaces of different descriptions can be practically accomplished; and the **EVIDENCE** detailed in the Appendix will show that the object the House had in view has been satisfactorily and effectually obtained.

5 July 1820.

WITNESSES.

<i>Mr. Josiah Parkes</i>	- - - - -	p. 5 & 17.
<i>Mr. William Phipson</i>	- - - - -	p. 7.
<i>Frederick Perkins, Esq.</i>	- - - - -	p. 8.
<i>Mr. James Spurrell</i>	- - - - -	ibid.
<i>Mr. Benjamin Hawes, jun</i>	- - - - -	p. 9.
<i>Charles Mills, Esq. (a Member)</i>	- - - - -	ibid.
<i>Dugdale Stratford Dugdale, Esq. (a Member)</i>	- - - - -	ibid.
<i>Michael Angelo Taylor, Esq. (Chairman)</i>	- - - - -	p. 10 & 16.
<i>Kirkman Finlay, Esq. (a Member)</i>	- - - - -	p. 11.
<i>Henry Monteith, Esq. (a Member)</i>	- - - - -	ibid.
<i>Mr. William Brunton</i>	- - - - -	p. 11 & 14.
<i>Mr. James Scott Smith</i>	- - - - -	p. 13.
<i>Mr. Peter Whitfield Brancker</i>	- - - - -	p. 15.
<i>Mr. John Wakefield</i>	- - - - -	ibid.
<i>Thomas Fleming, Esq.</i>	- - - - -	p. 16.

2 July 1820

APPENDIX;

VIZ.

MINUTES OF EVIDENCE.

Martis, 30^o die Maij, 1820.

MICHAEL ANGELO TAYLOR, ESQ.

In the Chair.

Mr. Josiah Parkes, called in; and Examined.

WHERE do you live?—I live at Warwick.

What are you?—I am in partnership with my father and brother as a worsted manufacturer.

Mr. Josiah Parkes,

Have you occasion to use a steam engine?—We have a steam engine of about twenty-six horse power.

How many inch cylinder?—Seven-and-twenty inches.

How long have you used the steam engine in your works?—About five-and-twenty years.

Did you originally find any inconvenience from the smoke of the furnaces that heated the boilers of the steam engine?—Yes; and have practised methods for reducing our smoke for some years; I can speak, myself, to about six, but lately, from the introduction of an invention of bleaching, we found that our bleaching or drying-ground was much inconvenienced by the smoke.

How near is the bleaching-ground?—It is close to the works, extending about two hundred yards in length, beginning about ten yards from the mill; we were greatly annoyed by the smoke, and directed our attention to its entire removal.

Have you been able to accomplish it?—We have been able to accomplish it so far, that for about twelve hours of the day the smoke is nearly invisible; and we find also from the mode we adopt of making the fire, a very considerable saving of fuel.

It is not only invisible, but it does not injure the bleaching-ground?—Not at all; there is no soot, because the smoke, together with the solid charcoal, is consumed.

After the fire is lighted, for how long a time is there any smoke, and what is the description of that smoke?—We have three boilers, and we may say, that in an hour after lighting the fires we have heat enough to consume the whole of the smoke arising from them.

Is the smoke arising during the first hour of any great magnitude?—The smoke at first is very immaterial; after about ten minutes it is little more than the smoke of a common kitchen chimney, or any chimney as large as that, and not at all of a dark dense colour; it has a half-burnt tinge, almost immediately a red colour rather than black.

How long has this present apparatus that you use been put up?—The present most perfect state of our apparatus has not been in actual use many months, as we have made frequent alterations and improvements; but we have adopted a mode of firing, which we practise with it, greatly conducive to economy of fuel. Our daily consumption is twenty-five cwt. to supply our engine, dye-house, and washing coppers. We were formerly in the habit of using from thirty-six to forty hundred weight.

How many gallons or cubical feet of water are evaporated in the fifteen hours during which the engine works, by the consumption of twenty-five cwt. of coals?—I have not the result of my experiments here, but I have found that we usually evaporate seventeen cubical feet by the hundred weight of Wednesbury coals.

Mr. Josias Parkes.

Do you use steam of atmospheric strength, or above that?—Our steam is at a pressure of three pounds and a half on the inch, the ordinary pressure of Messrs. Boulton and Watt's engines.

Have you applied this species of apparatus to any other furnaces but your own, and where?—We have now just completed the application of it to three boilers at the brewery of Messrs. Barclay, Perkins & Co.

Has the application been made in any other place in any other part of the kingdom?—We have also applied it to the steam engine boiler at Messrs Hawes's soap works.

In London?—Yes.

Have you applied it at Birmingham at any place?—No, I have not yet applied it at Birmingham, but we are preparing to do it to five large steam boilers at Mr. Phipson's rolling mill, which work two engines, one of ninety, one of sixty horses power.

Have you had reason to be satisfied with what you have done at Messrs. Barclay and Company's brewhouse?—I am perfectly satisfied with the result; and the destruction of the smoke is nearly, if not entirely, as complete as at our own manufactory; but the Newcastle coals make a great deal more smoke and less flame than the Staffordshire, and therefore the destruction of the smoke becomes a much more difficult object; but I believe it to be very effectually performed.

A great number of persons have been at Messrs. Barclays brewhouse to see it?—A great number of persons have seen it.

How many days has it been up?—Two boilers to the engine have been at work about ten days.

Have you a model of your invention?—Yes.

[*The Witness produced his model.*]

Have you any regulator of the quantity of air admitted to burn the smoke?—Yes, there is an air-valve, which is regulated or closed at pleasure.

Is the result, as to the saving of coals the same as in your own works, at Messrs. Barclays?—We have not been able to ascertain the precise amount of saving at present, but we have no doubt of the result proving equal to our own.

What saving has taken place in the article of fuel by the change which you have made in your furnace?—We have reduced our consumption of coals by the combined adoption of the mode of firing with the destruction of smoke from thirty-six hundred weight to twenty-five hundred weight daily.

Have you found the draft of the fire-place materially affected by the introduction of the air to burn the smoke?—When much smoke is being made I have uniformly found the draft increased, because, by the conversion of the smoke into active flame, the rapidity of its passage is facilitated. I would wish to state one further circumstance, that I believe that this plan of burning smoke is applicable to works of various descriptions; and from the effect produced at Messrs. Barclays brewery under the three boilers that I have altered, I have received directions from them to proceed with one of the large brewing coppers.

When you speak of furnaces of different descriptions, do you mean to include furnaces for smelting ore, or vitrifying glass?—Not at all; I am not acquainted with them; I think it may be applied to annealing and reverberating furnaces, and most close fires.

What do you consider the saving by the alteration in firing, and the saving by the admission of air upon your principle?—I consider the form of the fire-place and mode of firing to be a great advantage, but I have not ascertained precisely how much of the saving may be attributed to the mode of firing merely, or how much to my peculiar mode of admitting the air: the total saving will be found at least one fourth.

Do you charge the fire-place with fuel in any particular manner?—We gradually push the fuel backwards as it becomes ignited, until the whole capacity of the furnace is one mass of coals; the feed-mouth is also then filled up, and the door is closed for the day.

What time do you occupy in doing that?—About two hours, with our Staffordshire coals, but after the first half hour there is scarcely any smoke; other coals may require rather more or less time, according to the rapidity of their action.

By this mode of firing is the heat more equable in its application to the boiler at the bottom, and will the duration of the boiler be affected thereby?—I think the duration

357
Mr. Josias Parkes.

duration of the boiler will be much greater from the low and equable temperature of the fire. I consider that this plan is very advantageous, particularly where engines are worked with a regular load, because the steam is kept up from the uniformity of the heat at a much more unvarying point of pressure.

You have stated that the heat is increased by the admission of air to burn the smoke; have you by any experiment ascertained the amount of increase?—I have placed a thermometer in such a posture, when the smoke was being consumed by the admission of the air, that it stood at 214 degrees; by the sudden closing of the air-valve, the smoke passing away unconsumed, the thermometer fell to 200°.

What is the appearance of the flame when air is not admitted, and when it is admitted to burn the smoke?—The appearance of the flame when no air is admitted is red and dusky, intermixed with quantities of smoke; and large quantities of soot are seen to come over from the fire with it; but when the air is admitted, the smoke catches fire with a brilliant white light, and the soot is evidently consumed. It is the combustion of the charcoal which produces the light.

What may be the general average expense of altering any furnace to adapt it to your invention?—The expense of alteration will be but trifling, probably about twenty or thirty pounds to each boiler; but the premium we should require for our invention we have not yet determined. As a proof of the small expense, and the little time attending the necessary alterations, the three boilers at Messrs. Barclays brewery were altered in five days.

Do you know what the expense of the alterations were?—We shall charge them about thirty guineas a boiler, exclusive of the premium.

Mr. William Phipson, called in; and Examined.

STATE where you reside?—I reside in Birmingham.

Mr. William Phipson.

State your profession?—I am proprietor of two large steam engines employed in rolling different metals; one, of a hundred horse, and another of sixty horse, power: our usual consumption of fuel, if we are full of work, is about sixty tons of small coals per week. I have had my attention particularly drawn to the consumption of smoke, as well as the saving of fuel, from the frequent complaints of my neighbours, and from the house having been once indicted for a nuisance.

What have you done in consequence of that?—I have paid a great deal of attention to the different plans that have been suggested for burning smoke, and have found them in general, if not always, attended with an increased consumption of fuel; and likewise so much care and skill required from the fireman as is seldom to be found in persons so employed.

Have you succeeded in the diminution of smoke?—We have succeeded in considerably diminishing the smoke; but we are very far from the perfection which has been obtained by Mr. Parkes.

Have you seen Mr. Parkes's steam engine?—Having been many years acquainted with Mr. Parkes, I have watched very closely the improvements that have been making within the last few years at his mill, and have found that he has succeeded for some time past, in a much more complete manner than any other person that I have known; but now, I consider that he has attained complete success in the consumption of smoke, attended with a considerable saving of fuel.

How often have you been present at Mr. Parkes's manufactory?—Very frequently; I am much in the habit of visiting Mr. Parkes.

Have you seen it in company with any other person?—I was obliged to pass a few days in Warwick during the last assizes, and had the pleasure of meeting the honourable Chairman, Mr. Dugdale, and Mr. Denman, when they witnessed the trial Mr. Parkes made of his plan, both in making as much smoke as he possibly could, and also his mode of diminishing it; and I believe they were all perfectly satisfied with its complete success. He was able always to destroy the utmost smoke he could make, by stirring up the fire: In consequence of this success, I immediately gave Mr. Parkes orders to alter the five boilers I employ for my two engines, as soon as he possibly could; and I am waiting with great anxiety for their completion.

Have you seen the furnaces at Messrs. Barclays brewhouse since they have been altered?—I have; and I consider the destruction of the smoke as complete there as at Mr. Parkes's at Warwick. I have heard it remarked, since I have been in town, that there is still a great quantity of smoke at Messrs. Barclay and Co., this arises from three large brewing-coppers, which have not yet been altered by Mr. Parkes; and the issue of smoke from these coppers is so great as to deceive persons

who

8 MINUTES OF EVIDENCE BEFORE SELECT COMMITTEE

Mr.
William Phipson.

who view the works from a distance : there is no smoke visible from either of the furnaces Mr. Parkes has altered, excepting what is purposely made when the plan is shown to persons who come to examine it. I believe that from Mr. Parkes's mode of firing, the boilers being subject to less variations of temperature, will last double the usual time : it is well known that in great heats, especially when unequally applied, the boilers will expand, and thereby be injured at the joints, as well as the brick-work about it.

What is your opinion as to the applicability of this plan of Mr. Parkes to large fires and furnaces in general ?—I believe it is applicable to all kinds of boilers, and to most kinds of close fire-places, but not to open fires.

Frederick Perkins, Esquire, called in ; and Examined.

Frederick Perkins,
Esq.

ARE you one of the partners in the brewhouse commonly called Messrs. Barclay, Perkins & Co. ?—I am.

Have you often witnessed in your own furnace from the steam engine, and the other furnaces for the conducting that great concern, great ebullitions of smoke arise ?—Very considerable.

So as to give great inconvenience to the neighbourhood ?—Of course we make a great deal of smoke ; but we have never been complained of.

Were you induced to try the method which Mr. Parkes has invented for abating the nuisance of smoke ?—Yes, certainly ; Mr. Parkes waited upon us, and informed us that he had a new method of consuming the smoke ; and when he explained it to us, and we saw the model, we were so struck with the simplicity and cheapness of the thing, we were anxious that it might have a fair experiment in the neighbourhood of London ; we therefore applied this apparatus to two boilers of our steam-engine, and I believe they were altered in the space of three or four days. When we worked them there was no smoke excepting at the first lighting of the fire ; after the fire was made up, and a regular heat produced, little or no smoke escaped from the chimney when the air-valve was open. We were then induced to apply it to another boiler of a different description, something similar to the large boilers which we employ in brewing ; in that boiler it answered most completely. We have not been able to form any opinion with respect to the saving of fuel upon this principle, because our fires are continually disturbed in order to show the experiment of consuming the smoke, and letting it escape, by throwing on a quantity of fresh fuel, and shutting the valve when a quantity of smoke escapes, and by opening the valve, it instantly disappears ; and you can repeat that experiment alternately, so that we have not been able to form any opinion with regard to the saving of coal, on account of so many people coming to see it ; it has never been left to its regular work ; but, in our opinion, it answers most completely, as far as regards the destruction of smoke ; and I am satisfied, if it was applied to any steam-engine, it would entirely do away with that nuisance.

As far as you have hitherto seen, do you think it will increase the consumption of fuel ?—Certainly not ; I should be induced to think that the consumption would be less ; but I beg leave to state that I cannot give any opinion with regard to our large brewing boilers ; our experiment has only been tried on our boilers of the steam engine and steaming copper. I think that the last gentleman who was examined, stated, that the public had observed that there was no diminution of smoke at our brewery ; the fact is, it is only applied to the boilers of the steam engine, and to a small boiler which is used for steaming casks. The three large brewing coppers which produce a large quantity of smoke it has not been applied to, therefore the public see no difference in our premises when we are at work, but we have directed Mr. Parkes to proceed with one of the coppers also.

You have said, you are convinced that there cannot be any increase in the consumption of fuel ?—Certainly ; but we cannot say what the decrease is, because our fires have been continually disturbed on account of persons coming down to see it.

Mr. James Spurrell, called in ; and Examined.

Mr. J. Spurrell.

WHAT are you ?—I am the brewer employed at Messrs. Barclay & Co's. brewhouse.

Will you state your own observation with respect to what the smoke was before and since the adoption of Mr. Parkes's alteration ?—Before we adopted Mr. Parkes's alteration for consuming the smoke we made a very considerable portion of smoke from

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from the steam engine, and since the adoption of Mr. Parkes's plan there is scarcely any smoke after the first of the morning; the fire, when once made up, will last from ten to twelve hours. The application has also been made to another copper, which we call the blowing-off copper, for blowing-off and steaming casks, and there the plan has been as successful as in the steam engine, very much to the satisfaction of the house.

Mr. J. Spurrell.

Do you know whether Messrs. Barclays are going to try it upon their other furnaces?—They have given an order to Mr. Parkes to try it upon one of their large coppers.

There must of course be a very considerable saving of labour in the way of making these fires?—The man who attends the fires has very little to attend to after he has made the fire in the morning, but opening and shutting the dampers.

So that there is a considerable diminution of labour?—That must necessarily be the case, the fire requiring so little of the man's attention.

What is your opinion with respect to the consumption of coal?—We have not been able to ascertain that at present, but we think it will be reduced in the blowing-off copper; we think that there appears, from the short trial that we have had of it, to be a saving of coal; and we are enabled to do more from this mode of firing than ever we did before, for I made particular inquiry this morning, and I found that the men who work at this fire are enabled to blow-off and to steam their casks at the same time, which is a thing they never could do before; that proves that the fire produces more heat.

Mr. Benjamin Hawes, jun. called in; and Examined.

WHAT is your business?—I am a soap-boiler, living with my father and my uncle at Old Barge-house, Blackfriars.

Mr. B. Hawes, Jun.

Have you employed Mr. Parkes to alter any of your furnaces?—We have altered our steam-engine furnace under Mr. Parkes's direction, and we find a very considerable reduction of smoke in consequence; with respect to fuel, I can hardly state whether there is any saving, not having had the returns.

Are you going to apply it to any other of your furnaces?—From what we have seen of its effects under our steam-engine boiler we are desirous of immediately applying it under one of our soap-coppers.

How long have you had it in use?—Since Tuesday last; we have scarcely come to any accurate results.

Charles Mills, Esq. a Member of the Committee, Examined.

HAVE you been at Warwick, and seen Mr. Parkes's manufactory?—Yes.

Charles Mills, Esq.

What is your opinion of it?—I saw the three furnaces in operation about a week ago, and I had an opportunity, by looking into the fire-place, to see the difference that was caused in the fire by the opening and shutting of the air-valve. In one case there seemed to be a thick smoke, and the fire clouded; in the other case the smoke was wholly removed, and there was a perfectly clear fire. I went out of the engine-house into the court, to observe the top of the chimney: In one case I observed scarcely any smoke visible coming from the chimney; in the other, when the alteration was made, to try the experiment, I found a very considerable quantity of smoke to arise. Of course I cannot speak to the diminution in the consumption of coal, because I have nothing but the information given me by the persons on the spot; I had no means of ascertaining it from observations of my own.

On the whole, are you quite satisfied as to the efficacy of the plan, from your observation of the machine itself?—As far as my observation went, the plan seemed to be efficacious and perfect as to the consumption of the smoke.

Dugdale Stratford Dugdale, Esq. a Member of the Committee, made the following Statement.

I HAVE attended Mr. Parkes's manufactory, for the purpose of seeing the trial of the experiments for consuming smoke by a method he has lately introduced, which appeared to me to be very simple, and at the same time to be perfectly efficacious.

Dugdale Stratford Dugdale, Esq.

Michael Angel Taylor, Esq. Chairman of the Committee,
made the following Statement.

*Michael A. Taylor,
Esq.*

" I WAS applied to about six weeks ago to take Warwick in my way to London, for the purpose of seeing the furnaces which were used in the works of Mr. Parkes. I of course appointed a time, and on my arrival at Warwick, in company with Mr. Denman, a member of this house, went into the manufactory of Mr. Parkes, and made every observation I could to satisfy myself of its efficacy in meeting the object which I have in view, that of diminishing the smoke of furnaces erected for the purposes of heating the boilers used for working steam engines, and for furnaces necessary in different branches of manufactures, as well as in brewhouses. I never thought, as far as my present inquiry and observation was directed, that the experiments which had been made, and which had been reported to me by Mr. Parkes and other gentlemen, could lessen the smoke that arises from furnaces used in the smelting of ores, or in the vitrifying of glass. My object in going to Mr. Parkes's was to ascertain how far his experiment could succeed in furnaces of the description I have before alluded to, let their power and extent be what they might, and to judge from every experiment I could there make, whether his plan would be generally applicable. On going into Mr. Parkes's premises I could not perceive the least smoke arising from any chimney in the place, so much so that I was at a loss to ascertain which was the chimney attached to the furnace which supplied the heat for the steam engine. I also noticed very accurately the garden which immediately adjoined the furnace, to see if from the flowers and from the different plants that were in that garden there was upon them the affection of soot or smoke; I could perceive none, though I inspected them very narrowly; I was anxious to make this trial, knowing from experience that the volumes of smoke which issue from the furnaces on every side of the river Thames opposite my own house, actually blacken every flower I have in my own garden at Whitehall. I afterwards went to the bleaching-ground, to judge whether there were any marks of soot or smoke upon the tenter-rail, on which were always hung the different articles for bleaching; I found no appearance of soot or smoke; the bleaching-ground was almost adjoining to the furnace. On going into the place where the furnace was erected, I desired that I might be allowed to assail the furnace in whatever way I chose, and by any experiment I thought proper to make; I mean by the word, assail, to see if by any experiments of mine I could create smoke. In the first place, I desired that the furnace might be opened and raked for a considerable time; no smoke was occasioned, indeed none had issued. I then directed that the valves which secured Mr. Parkes's experiments, and gave effect to his object, should be shut, and immediately the place was involved in smoke, which ceased on resorting to the apparatus again. Not satisfied with that, I desired that a very large body of coal might be put into the middle of the furnace, and that Mr. Parkes's apparatus should remain in the way it did remain when I saw no smoke; I then inspected whether or not, from that immense body of fuel, which I put on adventitiously, any smoke issued; none appeared. On the shutting of the different air-valves, an immense body of smoke issued; this convinced me that his apparatus was perfectly adapted to the object I had long in view; and that though many others had met my observation, yet none appeared to me so simple as his, and I desired Mr. Parkes to come to London, and apply in my name to persons who had steam-engines, and see if they would permit him to have their furnaces so altered, that the Public might judge whether or no his apparatus would give as fair a promise of success in London as it had done at Warwick. I waited on Messrs. Barclay and Perkins a few days ago, in company with Lord Harewood, Lord Rosslyn, and several other gentlemen, many of them Members of this House, to see whether the experiment had succeeded in the furnaces attached to that brewery. Every trial was made in my presence, and every trial succeeded; and I have no doubt that if there was occasion, several Members of this House, who were present, would attend and give evidence to the same fact. The success of the experiment was as complete at Messrs. Barclays as it was at Mr. Parkes's at Warwick."

Mercurii, 31^o die Maij, 1820.

MICHAEL ANGELO TAYLOR, Esq. in the Chair.

Kirkman Finlay, Esquire, a Member of the Committee ; Examined.

WERE you with other members of this Committee on a late occasion at Messrs. Barclays brewhouse?—I was.

*Kirkman Finlay,
Esq.*

You saw the apparatus that was fitted up by Mr. Parkes at work?—Yes.

You saw the different experiments that were made?—I did.

Are you satisfied with the result of them?—Perfectly so.

Quite satisfied as to the reduction of the smoke in the furnaces to which the apparatus was attached?—I was completely satisfied that it amounted nearly to a consumption of the smoke in consequence of Mr. Parkes's improvement.

You are well acquainted with the city of Glasgow, and you are perfectly aware of the extent of the nuisance of the furnaces in that place?—Yes, I am.

Do you think if this apparatus, or something similar, be attached to the furnaces, that a great part of that inconvenience would be remedied?—I am quite satisfied that if Mr. Parkes's improvement was generally adopted there it would remove every thing approaching to the shape of nuisance in that city.

Henry Monteith, Esquire, a Member of the Committee ; Examined.

I BELIEVE you were present with other members of this Committee at Messrs. Barclays brewhouse?—Yes.

*Henry Monteith,
Esq.*

Were you satisfied with the experiments which you saw made?—So far as I could form a judgment I was well satisfied.

I believe you are Provost of Glasgow?—Yes.

And I believe you are aware of the extent of the nuisance which has been occasioned by furnaces of different descriptions?—Yes; it is certainly a very public nuisance about Glasgow.

As far as you could judge of what you saw at the brewhouse, are you satisfied that the application of the same principle, if continued to be as successful as it is there, would very much benefit and relieve the city of Glasgow?—Yes, as well as other factories at a distance, for I have steam-engines myself at a considerable distance, and works, which are injured by the smoke; and if it proves as efficacious there as it appears it would, it would prove a benefit to myself.

Have you it in contemplation to adopt any of those plans?—Certainly.

Have you a steam-engine of your own?—I have two.

What are the powers of them?—The one is either a fifty-four or a fifty-six horse power, I forget which, and the other is a thirty-six horse power.

Are they working twenty-four hours?—No.

How many hours do they work?—I suppose the working hours, (they stop during meals,) will be from thirteen to fourteen hours, not more than fourteen.

Can you inform the Committee what quantity of coals are consumed by those engines?—No, I cannot; that calculation has never been under my attention.

What is the size of your cylinders?—I do not know; I am not conversant enough with the steam-engines to enable me to answer that question.

You do not know exactly the manner of charging the fire?—I do not know exactly the manner, I know they do it very frequently; there is a man constantly in attendance for the purpose.

Mr. William Brunton, called in ; and Examined.

WHERE do you live?—I reside in Birmingham, at the Eagle Foundry.

What is your general employ?—That of a civil engineer.

Have you turned your mind to the extinction of smoke in furnaces?—Yes, I have.

*Mr.
William Brunton.*

What progress have you made in the attempt to reduce the quantity of smoke emitted from furnaces?—Since I had the honour of giving my evidence at the last Select Committee, I have erected eight fire-regulators, all of which have given the greatest satisfaction as regards burning the smoke, one of which I erected at Whitechapel distillery, and another I erected at Liverpool, and they have uniformly effected a saving of coal, which on the average is more than 30 per cent. They

Mr.
William Brunton.

were applied to boilers which were originally erected by Messrs. Boulton and Watt, and justly considered upon the best construction of the common furnace. I beg that the Committee would be pleased to examine Mr. James Scott Smith, of the house of Liptrap and Smith, Whitechapel, and also Mr. Branker, sen. from Liverpool, who has come thus far unsolicited by me, and quite unexpectedly, to give evidence to the same facts.

What quantity of coal per hour can you burn with a *maximum* effect in your furnace, upon your grates, and at the same time consume the smoke?—This considerably depends upon the nature of the coal. In London, upon a grate of five feet diameter, we consume three bushels per hour; in Staffordshire and Lancashire, about three hundred weight. In general we burn with *maximum* effect more than can be burned upon a grate constructed in the usual manner, yet completely remove the nuisance of smoke, and this under the same sized boiler. The reason of this will appear, by considering that boilers are usually constructed large enough to receive the effect of the fire when it is in excess, which is the case between the intervals of putting coal upon the fire. With the fire-regulator we have no excess, but a uniformity of heat, which may with propriety be maintained above the mean temperature of the common furnace. And here I beg leave to remark, that this uniformity of temperature we are enabled to maintain displays by contrast many striking proofs of the injurious effects of heat in the common furnace above alluded to. First, by the fire-regulator we have much less scoriæ or clinker from the same quantity of coal, and that is formed in thin lamina upon the grate, so as to form a sort of coating to the bars, and prevents them from being ever heated to redness; and in general, while three bushels of coals per hour are consuming upon the grate, the bars are seldom so hot as to discolour writing paper, when pressed against them. Secondly, another effect, of considerable importance in London, is, that the fire-bricks which form a part of the fire-place are not even vitrified, and will therefore last very much longer than in the usual furnace. Thirdly, the boilers, in consequence of the regularity of the heat, may fairly be expected to last much longer, and the supplementary boiler, on which of course the greatest wear takes place, may at any time be taken down, while the principal boiler, with all its connecting pipes, remains unmoved.

What are the circumstances peculiar to the fire-regulator to which the saving of coal, in your opinion, is to be attributed?—First, by the very equal distribution of the coal upon the surface of the grate, maintaining a thin fire and a sharp draught; this is effected by the coal being introduced in small quantities falling upon the whole of the area of the fire in regular succession: Secondly, to the coal being introduced upon the fire without opening the fire-door; this is effected by dropping the coal through the roof of the supplementary boiler: Thirdly, to the decomposition of the coal, being much more perfect than by the common furnace; effected by the revolving of the grate, and thereby exposing each side of every piece of coal on the grate to the current of the fire passing constantly in one direction across the grate, I mean across its diameter: Fourthly, to the introduction of the coal, being completely governed by the steam generated; analogous to a water-wheel, governing by its velocity the quantity of the water permitted to fall upon it; thus, considering the production of the steam as the effect, and the introduction of coal as the cause, the former has a perfect check over the latter, and at no time admits more coal into combustion than is really necessary for the performance of the work which the engine is then doing: Fifthly, to the whole apparatus, being a very simple mechanical arrangement, acting independently of either the skill or the carelessness of the fireman.

Is it not necessary to break the coals into small pieces before they are put into the hopper?—No coals should be put upon a steam-engine fire until they are small enough to pass a three-inch mesh; therefore, the necessity of breaking the coal to that size is advantageous; but we have lately burned a species of small coal in our own furnace, and also in the town of Birmingham, which has till now been regarded as perfectly useless; and as such there are thousands of tons encumbering the ground in the Staffordshire collieries, incapable of being used with effect in any other furnace than the fire-regulator; and we have produced with this hitherto supposed rubbish, 70 per cent of the effect of saleable coal; thus bringing into use that which was of no value.

When you have obtained the maximum effect of the coal, have you had a thick fire and slow draught, or a thin fire with a sharp draught?—Decidedly the latter; and it is my opinion that the greater quantity of oxygen we bring into contact with

with the coal in combustion, the greater heat or effect we shall produce from it; and I consider the damper, though useful in its proper application, yet when constantly used, to be an imperfect attempt to save at least part of an excess of coal injudiciously thrown upon the fire, and thus devoted to destruction; in short, to use an illustration, I regard the damper as I would an extinguishing-engine standing ready before a house to extinguish the flames when it takes fire; whilst I consider it to be a much wiser plan to use such means as will effectually prevent the conflagration; that is my idea of a damper. In all this I am borne out by the current experience of the Cornish engineers, who, profiting by the counsel and recommendation of an honourable and scientific member of this Committee, Mr. Davies Gilbert, have generally adopted a thin fire and a quick draught, and the monthly report of the performance of the engines in that district bear ample testimony of the propriety of the measure.

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Mr.
William Brunton.

Is not your apparatus more expensive than the plans which others have adopted to burn the smoke; and will that expense be repaid by its advantages?—The fire-regulator, and the other modes proposed for burning smoke, stand upon very different grounds; for the value of a boiler, as an implement for generating steam, depends upon the quantity of coal which may be burned under it producing a *maximum* effect; and when any change is made in a furnace, by which either the quantity of coal consumed with a *maximum* effect is diminished, or the effect of the same quantity of coal is decreased, in either case it is injurious and expensive; the former is injurious as it relates to the boiler, because either a larger or an additional boiler will be necessary; the latter, as relates to the coal, because a greater quantity must be required to do the same work: I venture to affirm, generally, that where well-constructed furnaces have been altered, in order to consume the smoke, one or other of these effects have been produced; on the contrary, the fire-regulator, while it increases the quantity of coal consumed, increases the effect also, and thereby increases the value of the boiler to which it is attached, as it will raise a greater quantity of steam at much less expense. The usual plan adopted consists of a mere change in the form of the furnace, which, when appreciated by the proprietors, is of no more value than it was before; but the fire-regulator makes a positive addition to the size of the boiler, and is tangible property, and when the proprietor takes his stock stands for its own cost.

Is what you say respecting the common furnace the result of practice, or merely of observation?—The greater part of my active life has been spent in the employ of Messrs. Boulton and Watt; first, as an operative servant, and for many years as the superintendent of their manufactory, during which time I had a good deal of experience in this subject; the drawing I now present is of a furnace erected by me at Nottingham ten years since, which burnt the smoke as well, and perhaps with as little loss, as any other I have seen; it is at the service of the Committee [*delivering in a drawing*]; it has no reference to my present plan of burning smoke, and there is nothing particular in its construction further than the air is made to pass through chambers of brick-work, and brought into contact with the flame by means of holes in the bridge-wall, through which the air is permitted to come in contact with the smoke.

Mr. James Scott Smith, called in; and Examined.

WHERE do you reside?—At Whitechapel Distillery.

What are you?—A rectifying distiller.

Mr.
James Scott Smith.

Where is the apparatus situated that is erected on your premises?—At the malt distillery adjoining, belonging to Messrs. Liptrap and Smith, which was put up at my recommendation, and under my immediate inspection and superintendence.

When was it erected?—It was erected a short time previous to last March; it has been in use since that time.

Will you please to state what has been the result?—We have found that we can consume the smoke to a very great extent, and although it is not completely invisible, yet it is never offensive; we never have any of those dark volumes of smoke which are the cause of so much complaint. I have never understood that it is possible to consume the smoke entirely; and I believe there is no plan or apparatus which professes to do so. The fire-regulator invented by Mr. Brunton has many advantages; 1st. The boilers to which it is attached have their power greatly increased, will last a longer time, and will not be so liable to leak as those on the old plan, which arises from the circumstance of the fire-door not being opened to introduce the fuel, consequently the frequent draughts of cold air are excluded, and the

boilers

Mr.
James Scott Smith

boilers retain an uniform temperature. 2dly. There is a great saving of fuel, viz. 38 per cent., and this is the average of a three weeks experiment with the fire-regulator, compared with the work of three men in a three weeks experiment on the old principle.

How does that saving arise?—The quantity of coal admitted on the fire from the hopper being controlled by the engine itself, is always in exact proportion to the steam required, and consequently the fire is independent of the care of the workman, and not subject to his irregularity.

How is it in the other case;—When the coal is thrown on the fire, the fire-door must be opened, and cold air is thereby introduced, which greatly counteracts the effect of the fire upon the boiler, and this being repeated frequently, causes a greater consumption of fuel. We consume with the fire-regulator nearly two and a quarter bushels per hour.

That is at present what it consumes?—Yes.

How much did you formerly consume?—We consumed more; but I did not take an account of the exact quantity consumed in the hour. Where an engine is at constant work the saving will be greater in proportion, because, in our experiment, we only worked at intervals, making about five hours in the whole day.

What is the size of your engine?—A twenty-horse power.

What is the size of the cylinder?—The cylinder is twenty-four inches diameter. With respect to the advantages of the fire-regulator, I should add that the expense of repairing the brick-work of the furnace is very materially reduced, say four-fifths; it is not so liable to be out of repair, and can be renewed in much less time than the brick-work on the old plan; the bars will last for a much longer time, and the quantity of the clinkers is very considerably lessened, in the proportion of six to seventeen, on the old plan; they do not run together in such large pieces in the fire-regulator as in the common furnace, nor do they adhere to the bars. The grand principle in this machine is, that it makes all stokers alike good, and they always use the same quantity of coals when doing the same work; there is also a considerable saving in labour by this method. I am completely satisfied with the success of the apparatus.

Do you ever find the machinery embarrassed by the falling of the cinders on the wheels in the ash-pit?—The machinery can never be embarrassed, and is not likely to be out of order; because with respect to the wheels, there is a plate which covers them, and protects them from the ashes that fall through the fire-grate, which ashes are forced against a scraper as the wheel revolves, and thrown off at the edge into the lower part of the ash-pit intended to receive them.

Do you know the expense of erecting an apparatus of this description, of which you have been just speaking?—I conceive the machinery and alteration, all together, have cost us two hundred and fifty pounds; there are extra things which we ordered, but we do not consider them as part of the present apparatus.

In that amount you mean to include the remuneration to the patentee?—Yes.

Was the furnace which the boiler was put to, new, or was it attached to an old furnace?—It was attached to an old furnace, with which we made a three weeks experiment, previous to this apparatus being erected.

Does the expense apply to one or two boilers, which you say is 250 l.?—To one boiler.

Mr. William Brunton, again called in; and Examined.

Mr.
William Brunton.

WHAT may be the general expense of altering an old furnace for the purpose of applying your apparatus, so as to make it effectual to a twenty-horse engine? I conceive that the expense would be about three hundred pounds; but I would observe, that in London the apparatus would be paid for from the savings of not more than eighteen months, and in Staffordshire, at the most, three years.

Does that sum of 300 l. you have stated, include remuneration to the patentee, and every other particular?—Yes; I would add, that this apparatus includes the advantages of every other mode of burning smoke, combined with a saving of coal, arising from the practicability of having a thin fire and a quick draught, which in the usual mode cannot be attained.

Do you mean to state, that though the smoke may not be entirely consumed, or so well consumed, as by some other apparatus, yet that disadvantage would be counterbalanced by the saving of coal effected by the use of your machine?—No; I mean to say, we burn our smoke as completely as any other; and at the same time,

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time, we have the additional advantage of burning the coal more perfectly over a quicker draught, which is decidedly an improvement.

You say that there is no invention by which smoke can be more effectually consumed than by your apparatus?—Yes, that is what I say; but I consider economy as an additional advantage.

Do you mean to include all expenses whatever, when you say the expense for putting up your apparatus is three hundred pounds; would it include the carriage of materials, and every thing?—Very likely that is different in different parts of the kingdom; in some places our brick-work costs next to nothing to what it does in London, and other things in the same ratio. Sometimes we have a good deal to pay for carriage, and sometimes we have little or none to pay, but in general, when speaking upon that subject, I rely that the thing in London will pay for itself by the saving of fuel in eighteen months in general.

What part of the expense of the three hundred pounds do you consider as a remuneration to the patentee?—About sixty or seventy pounds.

Mr. Peter Whitfield Brancker, called in; and Examined.

BE so good as to state to the Committee what is your profession, and whether you applied to Mr. Brunton for an apparatus to be fixed in your works for the purpose of consuming the smoke, and what has been the success of this apparatus?—I am concerned in a large sugar refinery, which is worked by steam; and finding that we had not sufficient power of steam, we applied to Mr. Brunton to erect an additional boiler, having heard that it would also have the effect of burning the smoke; one of my sons waited upon Mr. Brunton at Birmingham, and he saw the effect of the apparatus at that place. The apparatus was fixed upon one of our boilers, it was finished early in May, about the second of May in this year; and I saw the operation from the commencement; and during the time I was in Liverpool I watched the process carefully, and took notice of the difference of the power of the steam, and the quantity of smoke compared with what was emitted formerly, and I found that although the apparatus was not perfect for want of the other boiler being also fixed, that the quantity of smoke was very trifling indeed, little or nothing, and that our power of steam was very much increased, and that we could do the same quantity of work in about one hour less time which, was saved in about fifteen; the quantity of coals saved, as far as I could judge from my knowledge, was something better than one fourth, about 30 per cent. from what I have understood we shall save nearly one third. I am perfectly satisfied with the result, it has caused a good deal of inquiry in Liverpool, many persons have been to examine into the apparatus, and I am certain it will go forward, and that many persons will adopt it.

What power is your engine?—A two-and-thirty-horse power.

Mr. John Wakefield, called in; and Examined.

WHAT are you, Mr. Wakefield?—I now pay attention to apparatus for the purpose of consuming smoke. Thirty years ago I was acquainted with the town of Manchester. A Mr. Drinkwater had then erected the first mill that was built for mule-spinning in England, in a populous part of Manchester; he did not wish to be offensive to his neighbours there. I turned my attention first to that subject with Boulton and Watt's assistance (it was one of their engines), we consumed a part of the smoke, but it took more coals by ten per cent. than the old mode. In the year 1816 I again turned my attention to this subject, it was much wanted in Manchester, and no progress had appeared to be made. In 1817, print works were erected near to Earl Wilton's, at Heaton, on his lordship's property; this was to be on condition that they should make no nuisance on his grounds, which I have done with a low chimney, not so high as that of the houses; the next was Mr. Jonathan Pollard's, who had an engine set up by Boulton and Watt, and he tried a smoke-burner made by Mr. Robertson of Glasgow, but it did not give satisfaction. My principle was applied, which saved him twenty-five per cent. in coal, and consumed the smoke completely, except a little at the renewal of the fire, which I have now obviated. Mr. Jowle, a brewer in Salford, was under indictment by the magistrates for a nuisance occasioned by the smoke; he applied to me, hearing Mr. Pollard's was done, and the alteration was made under his brewing-coppers; it had the desired effect, and he so much approved of it by its saving of twenty-five per

*Mr.
William Brunton.*

*Mr.
Peter W. Brancker.*

Mr. John Wakefield.

Mr. John Wakefield. per cent., and making his premises cleaner, that he had his steam-engine boilers altered, for which he was not indicted, and he also had other works where he had alterations made in the same manner; he is now setting up a new brewing copper, and we are now going on with this also. I have applied the same invention to other works at places for calico-printing, where the pieces lie on the ground, and where the oxydes of iron and blacks stain them, which inconvenience is now obviated to their satisfaction.

You mean to say it has succeeded in the reduction of the smoke?—Yes; and they have given me recommendations, and I am to be employed at other places by persons who are aware of the success of my invention. To show that I am not over sanguine, I have testimonials of the results of my invention from a variety of persons, which I beg to produce to the Committee; they will see the respectability of the names. I have also very satisfactory testimonials from several gentlemen residing at Amcoats, where a steam-engine of Mr. Gold's was a very great nuisance to the neighbourhood, and the Committee will see by that testimony that the resident gentlemen about it are satisfied.

What is the saving of coal?—From forty-five tons eleven hundred-weight per week; the alteration of one boiler in that period saved eight tons; the second boiler was altered, and saved fifteen tons out of forty-five tons; they were then using three boilers, they are now using two, and they have a greater quantity of heat produced than in the usual mode.

Please to state what is the expense?—The expense is little more than the usual way in which they are erected by Messrs. Boulton and Watt, only more pains are taken in the brick-work.

Can the principle be applied to an old furnace?—Yes; there is no further expense excepting that of my premium, and for which six months saving will satisfy me. I am speaking of a new apparatus.

Suppose it is attached to another?—For a twenty-horse-power engine it would be twenty or twenty-five pounds, besides what I charge for my remuneration.

What is the nature of your apparatus?—With the permission of the Committee, as I have no patent, I would beg leave to decline stating the nature of my improvements. I am now making application for a patent.

Michael Angelo Taylor, Esq. Chairman to the Committee,
made the following Statement.

*Michael Angelo
Taylor, Esq.*

I THINK it right to state that I have witnessed the apparatus which Mr. Wakefield put up at the distillery of Messrs. Cook, & Co. Mill Bank, Westminster, and I had an opportunity of witnessing the different furnaces in those works, two of them had Mr. Wakefield's apparatus, and the remainder had not, and those that had not the apparatus emitted immense bodies of smoke, and two that had the apparatus simply emitted the smoke of a common chimney; and upon inquiry I found out that even those two furnaces were not in such order that day as they usually were, and that on several days scarcely any smoke was perceptible.

Thomas Fleming, Esq. called in; and Examined.

*Thomas Fleming,
Esq.*

WHAT are you?—A merchant, residing in Manchester. I have been a commissioner under the Police Act for the last twelve or fourteen years, nine of which I have been treasurer, and have had a great deal to do in the management of that place. Under that Act, we have a clause which empowers us to force parties complained of to burn their smoke. During the time I have been a commissioner I have been, perhaps, twenty times appointed one of the sub-committee, in consequence of complaints made by individuals, owing to nuisances arising from the smoke in their neighbourhood. The commissioners, I ought to state, never interfere under the powers of their Act, unless a complaint is made from the parties aggrieved; the commissioners then appoint a select committee to view the place complained of, and that committee reports again to another general meeting of the commissioners concerning the manner in which they think the nuisance may be removed; there is then an order made by the commissioners that that alteration shall take place within a limited time, such as is supposed to be reasonable, and if it is not then done, the penalty of our act is enforced, which is £.2 per week as long as it remains. In consequence of a complaint of the neighbours of Mr. Gold's Mill, I went to look at Mr. Pollard's, which

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which had been altered by Mr. Wakefield; and I recommended Mr. Gold to employ Mr. Wakefield in consequence of the great improvement I saw at Mr. Pollard's. The neighbours, who were the complainants, have since told me they were perfectly satisfied with the alteration, and that it was no longer a nuisance; and I have likewise had an opportunity of seeing Mr. Jowles's, which Mr. Wakefield has put up, that I can see from my own sitting-room window and see it daily. They were indicted by the magistrates in consequence of the great smoke which was emitted, it being very near to the prison. I am rather, myself, an early riser, and see it when they first light the fire, and it puts up very little smoke at that time, and scarcely any during the day afterwards.

Thomas Fleming,
Esq.

Mercurij, 5^o die Julij, 1820.

MICHAEL ANGELO TAYLOR, Esq. in the Chair.

MR. *Josiah Parkes* stated to the Committee, That since their last meeting he has applied his plan of consuming smoke to other boilers, two of which belong to an engine of ninety-horse-power at Birmingham, with the same unvarying success as at Messrs. Barclays brewery: That he has had the satisfaction of receiving from many scientific gentlemen of the greatest eminence, who have witnessed the effects of his invention, the most unreserved approbation. Amongst the numerous visitors, he can mention the names of Dr. Wollaston, Sir H. Davy, Mr. Brande, Mr. Children, Mr. William Allen, Mr. Pepys, Sir Geo. Tuthill, Sir Geo. Cayley, &c. all or any of whom he might have requested to attend the Committee, to bear testimony to the truth of the principles he has adopted.

Mr. Josiah Parkes.

He can now state that the diminution of the consumption of fuel, both at the engine and steaming-copper at Messrs. Barclays, fully equals the expectations he stated to the committee, founded on his experience at Warwick. From the accounts of coals rendered to him by Mr. Spurrell, and signed by him, the saving at the engine is one fourth, and at the steaming copper one third, and Messrs. Barclay and Co. have desired him immediately to alter the only remaining boiler they have for heating water. The large brewing-copper, upon which he was desired by Messrs. Barclay & Co. to try the effects of his plan, has been worked only four days. The smoke is certainly diminished; but he thinks it proper to inform the Committee, that from the necessary irregularity of the heat of the fire under a brewing copper, compared with a steam-engine boiler, the difficulty of effecting so entire and uniform a destruction of the smoke will be apparent to every person at all acquainted with the subject.

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R E P O R T
FROM THE
SELECT COMMITTEE
ON
STEAM NAVIGATION,
TOGETHER WITH
THE MINUTES OF EVIDENCE
AND
AN APPENDIX AND INDEX.

Ordered, by The House of Commons, to be Printed,
14 October 1831.

R E P O R T

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R E P O R T.

THE SELECT COMMITTEE appointed to take into consideration the frequent Calamities by STEAM NAVIGATION, and the best Means of guarding against their Recurrence, and to report their Observations thereupon to The House ; and to whom several Petitions were referred ; and who were empowered to report the MINUTES OF THE EVIDENCE taken before them, with an APPENDIX ;—HAVE, pursuant to the Order of The House, examined the Matters to them referred, and agreed to the following REPORT :

YOUR COMMITTEE, impressed with a deep sense of the importance of the subject referred to them, as well from an earnest desire, on the one hand, not to check, by Legislative interference, the progress of Improvement in the application of the vast Power of Steam to Naval Purposes, as, on the other hand, to afford Protection to the Lives and Property of His Majesty's Subjects, and to ensure a due regard to the security and protection of all public and private interests, feel themselves called upon to recommend that all Vessels propelled by Steam shall be subjected to certain Regulations.

Your Committee deem it right to remark, that notwithstanding the recent distressing calamities which have befallen two Steam Passage-Vessels, by which many lives have been lost, and which Your Committee, in common with the rest of the Public, deeply deplore, yet, that when the great number of Steam Vessels employed in carrying Passengers, and the period of time they have been in general use, are considered, the number of fatal Accidents appear to have been comparatively few, and less in proportion than the Accidents to Sailing Vessels.

Your Committee having duly weighed the foregoing Considerations, having considered the several Petitions referred to them, and the Evidence of numerous Witnesses, whose character and professional experience seemed best calculated to afford the required information, and having referred, in the first instance, to complaints connected with the Navigation by Steam on the River Thames,—REPORT as follows :

Firstly, That numerous Persons using, and employed in small Boats, and on board Loaded Barges (as has heretofore been customary), on the Thames, in the vicinity of London, are now daily exposed to much serious inconvenience and personal risk from the manner in which Steam Vessels are continually passing in that crowded part of the River called the " Pool," causing great undulation of the water to a considerable distance, and within that range subjecting the small boats and loaded barges to the foregoing evils.

Secondly, That the usually rapid rate at which Steam Vessels move, and the undulation of water they occasion, render it highly important that those in charge of them, whilst navigating even the less frequented parts of the Thames and other

Rivers, should adopt every reasonable precaution to avoid injury to small Boats or deeply-laden Vessels, by approaching nearer to them than necessary.

Thirdly, That it appears that Steam Vessels employed to convey Passengers from one Port to another by Sea, as well as between different Places in the same River, have not always been built with adequate strength of Scantling; by which means their Passengers have been exposed to immediate danger, in the event of such Vessels experiencing the violent Shocks that are occasioned by striking on Shoals, encountering heavy Seas, or other Sea Risks.

Fourthly, That there is not at present any general fixed Signal to distinguish Steam Vessels when moving by Night; and that it would be advantageous, on account of their rapid rate, and other circumstances before alluded to, that they should be so distinguished, in order to afford timely notice to Boats and other Craft to get out of the way.

Fifthly, That considerable inconvenience has been experienced by the practice of several Steam Vessels starting from one point at the same moment, and keeping together, whereby the danger arising from the undulation of the water is greatly increased.

To remedy these evils so far as appears practicable and just, your Committee deem it right to submit to the House the following suggestions; viz.

Firstly, That it is expedient to regulate the speed of Steam Vessels between London Bridge and the Stairs of His Majesty's Victualling-yard at Deptford, and that the basis of the Regulations be arranged upon the revolutions of the wheels.

Secondly, That by Legislative Enactment Steam Vessels be required, whilst navigating between London Bridge and the Stairs of His Majesty's Victualling-yard at Deptford, if going with the tide, or in slack water, to have the number of the revolutions of their wheels reduced one half from their average performance at full power of their engines; and if going against the tide, to have the revolutions reduced one third from their performance at full power. The average performance at full power of the wheels to be ascertained and certified to the Commissioners of Customs of the Port to which the Vessel belongs, and to be notified in some conspicuous part of the Vessel; and that there be in all Vessels navigating the Thames an Index on the Deck, connected with the machinery, to show the number of Revolutions per minute the wheels are making.

Thirdly, That every Steam Vessel employed in the conveyance of Passengers for hire, shall be duly licensed by the Collector or other chief Officer of the Customs of the Port to which she belongs; and that such Officer, previous to granting a License, shall require such proof as he shall deem reasonable and proper (taking into consideration the circumstances of the case) that the Vessel has been sufficiently surveyed and examined, and is deemed to be perfectly Sea-worthy, of sufficiently strong Scantling, and properly fitted in all respects to undertake the Service or Voyage for which she is intended.

Fourthly, That such License shall only be valid for one year; it being understood that if any Vessel be out of the Kingdom at the expiration of the year, her License shall be valid until her return to Great Britain; and further, that in the event of its being proved to the satisfaction of such Officer that any Vessel has sustained any accident, it shall be in his power to order an intermediate Survey; and further, that it shall not be lawful for any such Officer to allow any Sea-going Vessel to be more than three years, or any River-going Vessel to be more than five years, without undergoing a regular Survey.

Fifthly,

Fifthly, That no Vessel shall be licensed to carry more than Two Passengers for every ton of her registered burthen, if to proceed to Sea, or more than Three if her Voyage is to be confined to River Navigation, after deducting the number of tons of cargo the Vessel may have taken on board, and deducting Four Passengers for every horse or head of horned cattle.

Sixthly, That the Commander or other Person in charge of any Steam Vessel, when navigating within Rivers or along Shore by Night, be obliged to show Two Lights horizontally, at least eight feet apart, and at least twelve feet above the Deck, (though higher if convenient), on a Mast in the fore part of the Vessel, and One Light under the Bowsprit (if the Vessel carry one), otherwise at the Stem under the Gunwale.

Seventhly, That every Steam Vessel proceeding to Sea shall be required to carry a Gun or Swivel, and Bell, for the purpose of making Signals.

Eighthly, That every Steam Boat carrying Passengers, destined to proceed to Sea, be provided with Two Boats at the least, of sufficient size, according to her tonnage and the Voyage she has to perform, to be judged of by the chief Officer of Customs of the Port from which she sails; and if the Vessel be destined for a greater length of Voyage than 100 miles at Sea, that she must have Three such Boats at the least; and all Vessels for River Navigation, One such Boat.

Ninthly, That in all Steam Vessels the Name of the Captain, the Number of Engineers and Crew on board, the Number of Passengers she is licensed to carry, and the Number of her Boats, shall be placed in some conspicuous part of the Deck.

Your Committee submit, that Legislative Enactments to the foregoing extent cannot prove onerous or detrimental to the Proprietors of Steam Vessels, in any degree to counterbalance the security and satisfaction they are likely to afford the Public; but that on the contrary it is probable they will eventually prove advantageous to the Steam-boat Proprietors themselves, from the increased confidence which will thereby be created in this mode of conveyance.

Your Committee, although not prepared to recommend any present Legislative Enactments on the following points, deem it nevertheless proper to draw attention to some parts of the Evidence brought before them; from which it would appear,

Firstly, That Steam Vessels built with timbers placed and secured according to the plan of Sir Robert Seppings, and without inside lining planks, at the same time that they possess greater strength, afford a ready means of frequent examination of the timbers, without expense or inconvenience.

Secondly, That Steam Vessels fitted with Paddles upon Mr. Morgan's, Mr. Perkins's, or any other effective principle of feathering, would be considered less likely to do injury to small Boats, or deeply-laden Craft, by passing near them.

Thirdly, That it has been suggested as likely to prove advantageous in preventing accidents, that Steam Vessels should be fitted with a Platform and Steering-wheel, to be placed in the fore part of the Vessel when navigating within Rivers, so that the Man steering shall be enabled to see over the Bow any objects floating or passing near; a plan stated to be now adopted in all the River Steam Vessels in America.

Fourthly, That it should be generally understood that, whenever two Steam Vessels find themselves unexpectedly near each other "Stem on," both Vessels are to put their Helms a-starboard, unless there be some evident cause to prevent it; and if the Vessels be not directly "Stem on" to each other, their Helms should be only altered so as to make them sheer from each other.

Fifthly, Although not perhaps strictly within the subject of the special Inquiry with which they have been charged, Your Committee deem it right, in closing this Report, to add, that Wherries appear to be now in use for carrying Passengers on the Thames, below as well as above London Bridge, built much shallower and slighter than formerly, insomuch that some of the smaller ones are scarcely safe, without reference to their meeting with Steam Boats or other extra trial. Also, that it appears that the Regulations and Directions for keeping a proper extent of Passage-way on the Thames near London, for Vessels and Boats to pass up and down, are not duly attended to or enforced by the Harbour Masters, from which mischief and inconvenience result. Your Committee are therefore of opinion that it is necessary that the Authorities in the City, who possess jurisdiction in these matters, should forthwith have their attention called to them, with a view to their applying such early Remedies on these two points as they may be found to require.

Your Committee cannot refrain from drawing particular attention to the Evidence of a Gentleman, one of the Survivors of the Rothsay Castle Steam Boat, whose collected state of mind throughout that melancholy catastrophe has enabled him to give such Testimony as abundantly to confirm the necessity of some of the above Recommendations.

Your Committee, in conclusion, would direct the attention of the House to the practical Information contained in the Evidence which they present with it; and express their satisfaction at the great Improvement a few years have made in this most valuable species of Navigation, and at the strenuous efforts hourly making in all parts of the Kingdom to advance it to a yet greater degree of perfection, enlarge its application, and render it of the utmost utility of which it is capable.

14 October 1831.

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MINUTES OF EVIDENCE.

Jovis, 15^o die Septembris, 1831.

COLONEL SIBTHORP IN THE CHAIR.

Mr. *Joseph Beardmore*, called in; and Examined.

1. WHAT are you?—An engineer.
2. An engineer of what steam-boat; to the Company?—To the Company; looking after the different steam-boats.
3. Are you a manufacturer?—No.
4. Can you give this Committee information relative to the ordinary length of the stroke of the pistons, in the boats that ply generally upon the river Thames?—Of the Company's boats.
5. You are inspector of all the boats?—Of the Company's boats.
6. You are the engineer superintending the boats, as they come up the river?—Yes.
7. You can give this Committee information relative to the average length of stroke of the piston?—Of most of them.
8. What is the average length?—There is three feet; three feet six; and four feet.
9. What is the average number of strokes which those different lengths perform within the minute?—The three feet perform between 32 and 33; the three feet six, 30; and the four feet from 23 to 26.
10. Do you believe, or do you know that the average length of stroke, and the average number of strokes that are performed by engines, generally average from 25 to 30 in a minute?—Yes.
11. You cannot speak to other boats that generally ply upon the river?—No; I cannot.
12. You have, in each of your engines, a certain weight upon the barrel, to let off the superincumbent steam?—Yes.
13. Have you in general in your steam-boats, two of those barrels, or only one?—Some two, and some only one.
14. Which is the most used now?—One, I think.
15. Why do they prefer having one?—I believe it has been the opinion, that if one should stick, another would act.
16. Why then do you confine it to one?—To stand in less room; to be more compact.
17. Have you been much accustomed to the machinery of steam-boats?—Yes.
18. And seen the action of them?—Yes.
19. Supposing there were two, and the weight was taken off one, in what proportion would that reduce the speed of the vessel?—It is not reduced in that way.
20. Would that reduce the speed of the vessel?—She might keep under way for ten minutes; one is sufficient to exhaust all the steam the boiler would make; to let it off.
21. Therefore one being opened would have the same effect nearly as opening the two?—Very nearly.
22. How many fire-places have you generally in your steam vessels?—Four, six and eight.
23. Take a boat of six; does the leaving open of one door reduce the speed of the vessel?—I cannot say as to that.

Mr.
Joseph Beardmore.

15 September,
1831.

Mr.
Joseph Beardmore.

15 September,
1831.

24. In what time would the leaving open of all the doors stop the vessel?—It would not stop her.

25. Not at all?—No.

26. In what proportion do you suppose that the leaving all the doors open, would prevent her way in the course of ten minutes?—Perhaps one-third, as near as I can speak to it.

27. You never tried experiments of that?—No; we did not ever try experiments of that.

28. Supposing that the Committee were to wish to decrease the speed of the steam-boats in a regular proportion, what would be the easiest mode of effecting that object; still to keep her under command in way, but to reduce her speed?—It might be done by the engineer by reducing the number of strokes; that is the only way I know.

29. How would you do that?—By two valves; they are throttle-valves, we call them; we can shut them one third or half. The way it is done is, they give command on deck to “ease her more” and “more yet,” and you continue still shutting those valves.

30. Have you any mark that shows when that is reduced to half speed, or a third, or any number of degrees?—No.

31. It is only by turning that a little more or a little less?—By turning that a little more or a little less.

32. Would it not be a very easy manner to know how you had reduced your speed, by having a plan to count the number of strokes?—Yes.

33. And by having a mark on the side of the throttle-valve for the engineer to know how many degrees he was reducing that?—That would not regulate that very well, because suppose you are near the ground, your engines will number a greater number of strokes, and your vessel will yet not go so fast.

34. With reference to the shutting and opening of the throttle-valve, would not that depend upon the quantity of steam that was made at the time?—They keep a certain pressure of steam upon the boiler; the valve is a self-acting valve. I was speaking generally; the boats that have a sufficient supply of steam will always go at the same speed.

35. You must always preserve a quantity of steam to spare?—We always try to do that.

36. Therefore the mere closing or opening of the throttle-valve does not give an exact proportion?—Yes, it will give an exact speed to the boat. The safety-valve and the throttle-valve are different; with the throttle-valve you may stop the boat.

37. Provided the steam is always the same density?—Yes.

38. The safety-valve is not intended for anything but safety?—No; certainly not.

39. What is the average number of pounds in a square inch to which the engines of your teams work?—About four.

40. The safety-valve is charged with so many pounds weight?—Yes.

41. If the spindle of the safety-valve over which these weights are placed were numbered and marked as to their weight, by turning the throttle-valve to a certain fixed mark, and by relieving the safety-valve of a certain quantity of weight, would not that calculate exactly the rate of speed at which the vessel would proceed?—Not quite; I do not think it would so well as leaving the safety-valve alone.

42. How do you check if there is anything a-head?—It depends upon the captain and pilot; they give the word of command below, “easy,” and “more easy.”

43. How soon can you stop her?—Instantly; she makes three or four revolutions.

44. The stoppage is almost instantaneous; from the time that the word of command is given till the time that she is stopped what time will it be?—It will depend upon the weight of the vessel.

45. If the engineer is near at the moment he has the word of command, he can stop her?—Yes; she would make perhaps three or four revolutions.

46. A vessel from three to four hundred tons, supposing you wish to stop her as quickly as possible, what distance would she go in the water?—I cannot say that; I am not upon deck to see that.

47. You can venture to stop her short?—In three or four revolutions.

48. You mean three or four revolutions of the wheel?—Yes.

49. That is, that it would be unsafe to stop her at once?—You cannot do it.

50. Can you not reverse your engines?—Yes.

51. Supposing that you were going at the rate of ten miles, with an ordinary tide,

in what space do you suppose that upon an emergency you could stop the progress of the vessel, by backing or any other mode?—I cannot speak as to that; I am not on deck to see how far she would shoot.

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52. What is the average rate of speed of the vessels passing between Greenwich and London Bridge?—From half an hour to three-quarters; the quickest time we have ever gone in is half an hour with the tide.

53. What would it be against the tide?—Three-quarters of an hour; it depends upon what Pool you have.

54. Have you ever been an hour?—Yes.

55. That is, if the Pool should be crowded?—Yes.

56. What lights do you use on board at night for lighting the vessel?—We have different sorts.

57. Do you show any lights?—Yes.

58. What lights?—Three.

59. Where are they fixed?—One to the mast-head, one on the bowsprit, and one on the paddle-box; three or four, sometimes four.

60. Can you explain to the Committee how the machinery is acted upon to stop its working?—It is by reversing the steam on the piston; you have a lever that commands the slide-valve which admits the steam into the cylinder and out.

61. That has the effect, has it?—Yes.

62. At what rate do the vessels that you are connected with go upon the average when they have got their full power?—I cannot speak as to that.

63. Is there no way of calculating by the rate of the piston?—No; they heave the log sometimes.

64. Is it the custom of those vessels to slacken their pace when they come to Greenwich?—Sometimes, not always; it depends upon whether there is anything in the way.

65. It is not, in fact, a standing rule with the captain?—No.

66. If you have passed Greenwich on your way to London you go on pretty fairly; but if you see any boats that you are likely to run foul of, you slacken your pace?—Yes.

67. Have ever any accidents happened to your steam-boats?—Yes.

68. From your power not being slackened?—Yes.

69. When you reverse the engines is the action immediate on all parts of the machinery?—You must stop her first before you can do it.

70. Will you describe the operation of reversing the action of the vessel?—It is done by reversing the steam on the piston.

71. Supposing you must stop, will you describe the operation of stopping?—It is done by reversing the steam on the piston.

72. In reversing the steam, is not the throttle-valve shut?—It is kept open.

73. The throttle-valve is turned?—No, it is kept open.

74. Will you have the goodness to describe the process?—We have the command of the slide-valve, and instead of the steam going to the top, we throw it to the bottom.

75. What time does it take to go through all these operations which you have described?—Perhaps a quarter of a minute.

76. Then in a quarter of a minute you can have the wheels going astern?—Yes.

77. What accidents have happened particularly with your vessel?—We have been foul of barges and so on, but nothing very serious.

78. You are below always, I suppose?—Yes.

79. You have generally to attend to see the engine work?—Yes.

80. Is an engineer generally near those levers to throw off the steam?—Always, from Greenwich.

81. That is the position where he is placed?—Yes.

82. Did you ever know of any boats being swamped by your vessels?—Yes.

83. In any one accident what rate were you going at that time?—I cannot say as to that.

84. What wheels have you got?—Different sorts; some with circular paddles, and some with straight paddles.

85. Have you any of those used with feather?—No.

86. Do you know who has them?—One of the Government boats has them.

87. What do you think of them?—I cannot speak to them.

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K. B. Martin.

Captain *Kennett Beauchamp Martin*, called in ; and Examined.

88. WHAT are you?—I am in the command of The City of London steam packet, and deputy harbour master at Ramsgate, during the winter months.

89. Will you have the goodness to state to the Committee, when the order is given to stop an engine, how long it will go before it stops?—The effect with my vessel is almost instantaneous ; and I should say in 30 seconds the vessel's machinery is going astern ; retrograding.

90. What is the distance she goes previous to being stopped?—Not one alpha ; because the fans of the wheels oppose so great a resistance to the fluid, that she cannot proceed much further.

91. What is the size of your vessel?—129 feet in length, and 50 feet wide.

92. What is her tonnage?—230 tons ; I cannot speak to her precise tonnage.

93. What water does she draw?—Six feet.

94. What power has she?—100 horse, each wheel is equal to 50 horse.

95. What is her average power of going through the water?—I should say barely 10 knots : I should say an average of $9\frac{1}{2}$. I have found her going $9\frac{1}{2}$ by the log.

96. When she is going at that average, when you give your order to stop her, from the moment of the order to the time she stops, would it be only half a minute?—I am sure it would not be more ; the fans are four feet wider than the beams of the vessels ; the Committee would be surprised if they were to see the effect, the heavier the weight of the vessel, the quicker her way is stopped, because the body of the vessel also opposes the fluid. One of the Government vessels which draws a great deal of water opposes an immense body to the fluid also.

97. But she has got her way?—That might counterbalance the effect.

98. The fact is, that you find that as far as recollection serves you, your vessel has stopped certainly within the minute?—Certainly.

99. Your opinion is that it is half a minute?—I am certain that it is.

100. If the Committee understand you correctly, after the order has been given, you could stop her before she got half the vessel?—The effect to me, on deck, appears to be instantaneous ; the fact is, that the man stands between the engines, and places his hand on the valve as quick as the trigger of a gun.

101. Suppose you saw a boat a-head of you, and you had not seen it till it was the vessel's length from you, you could stop it without running over the boat?—I should not like to try the experiment ; I have seen a vessel a-head of me in that way, because one of the greatest troubles we are put to is, a waterman popping out of a tier of vessels a-head, and knowing we have a power of stopping, they trifle with us.

102. The engineer who was last examined, stated that he could not stop the machinery till three revolutions after the command has been given?—Those three revolutions take place in three seconds.

103. You agree with him in that opinion?—I should think he is correct in that respect, because the impetus which the vessel has through the water, must have some effect upon the fans to check the engine in stopping.

104. Was the engineer, when he mentioned that three revolutions were necessary, speaking at that period of reversing the engines, do you think?—No.

105. Do the Committee understand you to say, that in reversing the engine, any number of revolutions would necessarily take place?—I should say not, because the engineer, when he stops an engine, in all vessels which have two engines, which all vessels ought to have, when he has once stopped them, has to cast his eye to see which of them is retrograding, and he lets on the steam on that, and the vessel goes astern.

106. So that no revolution is necessary?—None whatever.

107. At what rate does the tide carry a vessel in the Thames, giving an average?—The tide depends a great deal upon the land waters at this season of the year ; I have seen the tide run down the Pool at five knots ; I have eased the vessel half speed, and she has been a great while getting up, because the ebb tide was running so strong.

108. Did she still go on a-head?—Yes, she still went a-head.

109. You say you eased your vessel to half speed, how do you do that?—The moment we leave the wharf to go down the Pool, it has always been my invariable practice to desire the engineer to go at half speed, the effect would be different in different vessels or engines ; the average number of revolutions is about 30 per minute,

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minute, but the vessel must be in very excellent order; she seldom goes more than 28, that is about the average. When the engineer is desired to go at half speed through the Pool, he shuts off a portion of the steam pressure from the cylinders, and of course my sole dependence is upon him, but I can tell from accustoming myself to the stroke of the wheel, it catches my ear from continual practice.

110. But he would have the power of counting it; when you reduce it to half speed, do you reduce it to half the number of strokes?—Yes.

111. In point of fact, is he charged to do that, and does he do it. When he goes at half speed, does he trust to his ear, or does he take a watch and observe whether he has reduced it half or not?—He takes no watch, and I think he does not exceed that by a minute, he is more likely to go under than over.

112. But a man of practice may know whether he is going at half?—Without a watch.

113. When the steam is reduced to half the number of strokes in that way, does it exactly make that effect upon the vessel's going; does she go half the number of knots?—Much nearer than a sailor would suppose, it comes very near it, and Mr. Brunel cast it out for me by mathematical calculation, and he said that it would have that effect.

114. What is the lowest rate of going at which she would steer?—I could not trust her in the Pool if she was not going four knots.

115. Then it is necessary for you to go through the Pool at four knots?—It is necessary to go at a great deal more than that, which I will explain. When there are conservatories of the Thames, which give to sailing packets and sailing vessels the privilege of tacking to and fro, and sailing up the Pool, they are not attended to; and as a commander of a sailing packet for 11 years, I know that I did more damage unavoidably, than I have done by a steam-boat.

116. Does your answer with respect to going four knots an hour, apply to your going with the tide, or against the tide?—Equally; I must have the vessel under my command, whether she is going with or against the tide.

117. When you state that you have had five knots of tide running against you, how many knots have you been then going?—We have been going about seven.

118. How long has that taken you?—I have been half an hour from the Hong Point at the entrance of the Pool, immediately opposite to Limehouse, up to St. Catherine's.

119. What do you call the distance?—I should think that distance to be two miles and a half.

120. Supposing the tide were running at the rate of five knots an hour, at its greatest rate, what is the smallest distance at which you could travel in an hour, keeping the vessel under proper steerage?—When we are going down with the tide, we are exposed to even more danger than when we are against it, because we may be driven over tier.

121. What is the smallest distance that you could perform, if the tide was running with you?—Eleven miles over the ground; I should require to go six miles an hour through the water.

122. You have stated that with a steerage of four miles you could go?—Not to be safe in a pool of 120 feet wide, which I am sure was the extreme width of it when I travelled it.

123. You would require to go six knots through the water to provide for the safety of your vessel?—Yes.

124. You have very often gone up the river with a vessel at less speed than six knots?—Certainly.

125. Without any risk of any danger?—Yes.

126. Then why should you say that you ought to have six knots?—The steam-boat occupied much more space; that is, without paddles.

127. If it is in action, that does not prevent your steering?—We have not the room that a sailing packet has.

128. Your bow is very much wider in your steam-boat than the bow of a merchantman?—It is about the same.

129. Then that is the part that you would strike the boat with?—That is the greatest danger with the paddle-box, and all the steam vessels have what they call the shealing-board at an angle with the bow.

130. Would the steam-boat answer her helm when she was going four knots an hour?—She would, but the length of them is very immense.

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131. What harm can you do to any vessel going four knots?—I think I can explain it. I think it was about a month back, when I was in the river, it blew a gale of wind at N.N.W.; there was a great many craft a-head of me, what we technically call dung craft, coal barges and others; I was obliged to ease the speed of my vessel; there were four Berwick smacks, which had left the wharf above me, those were going two knots to my one; if I had not been at liberty to escape by increasing my speed, they would have run me down.

132. Why would they run you down, might not they stop?—They will not stop.

133. Could they stop under the circumstances?—No, they could not.

134. If they had taken in all their sail they could have stopped?—Yes, if they had taken in all their sail.

135. Four knots an hour you stated was the least speed at which you could steer the vessel?—I said, to ensure the safety of my vessel it must be six.

136. Would you explain to the Committee what you mean by saying that a vessel would be under proper steerage at the rate of four knots an hour, but that for the safety of the vessel itself she must go at six?—When sailing vessels are cutting the Pool diagonally from side to side, it is necessary sometimes when a sailing vessel has stood over to one side of the Pool, and has just come about, to put on speed and go a-head of her.

137. Is a vessel under proper command going at the rate of four knots an hour?—Not under every circumstance.

138. Supposing a steam-boat was confined to her steerage with a rate, say four knots an hour, what would be the probable evils which would accrue from such a measure?—The sailing barges and vessels of that description would run up with us, going faster through the water.

139. Is that your only reason?—Yes.

140. Suppose you were going four knots through the water, and you were allowed to go no quicker than that in rounding a point or ridge where the tide would have an effect upon you, do you think you could steer clear of a tier or vessel?—I know the impossibility of it from experience; our vessels are of such a length, some of them are 150 feet long, so that when the bow of a vessel comes into one tide the stern sometimes remains in another; the eddy is acting as a lever upon the stern, and the tide upon the bow, which, if we were not to keep on at a certain speed, I am sure, in spite of all our efforts, the vessel would be driven to the other side of the river; the action of one wheel comes into one tide before the other.

141. Is not the difficulty increased from the increased velocity of the tide itself?—Yes.

142. Then although you would trust her with four knots in still water, you cannot trust her with four knots in a heavy tide?—In the Pool I cannot.

143. You understand the machinery of the vessel generally?—I do.

144. There are three valves to the vessel; there are two throttle-valves, and a safety valve?—There is in my vessel one safety-valve to the boiler; the only reason why two have been adopted is, that they have sometimes adhered from some principle that it is difficult to understand, and there is an aperture in the roof of the boiler to prevent any accident of that kind; our valve is contrived with a trigger under it, which has no connection with it, to keep it down; it is not at all to join it, but it is in the event of any suspicion of that kind to force it up.

145. Whereabouts is your safety-valve placed?—It is immediately over the centre of the boiler.

146. You could not get to that valve in an instant?—It would take an hour and a half to get at it.

147. Then you have no effect upon it?—Nobody has any.

148. Is not the valve always upon the move?—Yes; but upon the event of any suspicion arising that there is anything the matter with that valve, he has the power to lift it at once from the boiler.

149. Is it not at the bottom of the waste pipe?—No.

150. Are all vessels that way?—I believe the whole of them in the Company I serve has that.

151. Suppose that valve were thrown open, how soon would it stop it?—It would not have any effect upon it for many minutes.

152. For 20 minutes?—The steam would be so exhausted in 10 minutes, that it would stop; that valve would be only a secondary cause to apply to, when you had the other in your power.

153. You

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153. You have two throttle-valves, one to each cylinder; when these are open, that throws the steam over the piston?—It throws as large a column above as below it.

154. And that is the only way you have of stopping?—The only way.

155. Is not the impetus of the wheels going round very great, supposing you have reduced the weight of them so much, would they stop in an instant?—They must have three revolutions; I have seen them stop in an instant without one revolution; supposing in coming down the Pool that a bolt from one of the fans is driven out at the wharf by a pile, or something, when we lift up the cover of the paddle-box under which the wheel traverses, if I stand there I can tell the engineer to stop it in an instant at that precise point.

156. You say that you have made experiments with the vessel you command now?—Yes.

157. Could not a captain tell the rate of his vessel's going by the number of strokes of the piston?—There is no difficulty at all; but the Committee must allow me to make this observation, that the vessels that I have been in the habit of commanding have generally been in nearly the same trim; if you were to put 50 or 60 tons on my vessel I could not, but in the general trim of her I could tell to half a knot.

158. What is the average time you take from Greenwich to St. Catherine's, both against and with tide?—Our average time with the tide is from 30 to 35 minutes, and against the tide about, I should say, not more than 40 minutes; because we go faster against the tide; about three quarters of an hour; but the tides are so different, sometimes they do not run half the velocity; against a common ebb tide about three quarters of an hour.

159. Do you keep anything like a log-book on board?—Yes.

160. Regularly?—Yes; we have not so much to put down as a ship on a voyage has; we merely state the time we started from the dock and the passengers we take, and the quantity of coal we consume.

161. Do you find any inconvenience when you approach the Pool by the number of boats that come off for passengers?—I do consider that there is more danger in stopping in the Pool for a passenger than in anything else.

162. It is at present the practice?—Yes.

163. And where you should not have passengers, still the boats crowd round you looking for fares, whether you have or not?—They do, from that circumstance.

164. And very considerable danger arises from those boats crowding round you?—More than from any other circumstance.

165. If you found that your vessel could be steered with as much ease by a man looking over the bow from the forecastle, would not that be a great security against accidents from smaller boats?—I do not think it would.

166. Have you ever known any mistake made from your helmsman in the word of command?—No, because I always accompany my command with an action.

167. Is that done by all commanders of steam boats?—I do not know; I have taught my helmsman to consider that if I hold my hand up he is to steady the helm.

168. If the man were to stand upon the forecastle he would see the danger himself?—Yes, and I think the watermen would take advantage of that in order to trifle with us; even children have what is called a toss, in the undulation of the waters occasioned by our wheel.

169. You are not always upon deck yourself, you may be sometimes down stairs?—Not in the Pool.

170. You have spoken of the number of tons in your vessel; what is the average number of passengers per ton which you carry; what number would you say might be on board, to be safe, and not to be crowded?—It depends upon the vessels. Some of the vessels have sponsoons which go out half the width of the wheels, and some even to the extremity of it, as is the case with The United Kingdom. This gives them an immense capacity of deck, but we must not infer from that that it is capable of carrying all that increased weight; I do not think we ought to carry more than two passengers to a ton.

171. What number of boats have you on board?—Only one.

172. How many will that boat contain?—It would contain half a dozen to 10 people, but their safety would depend upon whether they were in smooth water or not.

173. With the great care that you take with your vessel, will you have the goodness to state to the Committee how many accidents have occurred to you?—During the 11 years I have had but three which could properly be called accidents; the first was one that I saw very much exaggerated the other day in the Morning Chronicle. A Mr. Lucy had stated there that he was in a boat with two

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servants and three children, and I run over him. We were coming up the Pool, and he had entrusted his servant maid, with three children, to a man who was so deaf that he was nicknamed deaf Lolley. Mr. Lucy was not in the boat; they pulled out from under a sailing craft; the vessel in lieu of going through the water was stopped at the time, or they would every one have been sacrificed, for the waterman rowed right into the wheel, and he sprung out and left the woman and three children to their fate; it happened to be on that side of the vessel on which I was, on the paddle-box; Captain Dance Dundas, now of the Regent, was standing close to me; the third child was missing; I heard it, pulled up the cover of the paddle-wheel and descended through the wheel, and finding, after having gone down through a wheel like that of 14 feet diameter, that it was impossible for me to ascend, I took the child in my arms and came out into the Thames; by that means they were all saved. The steam-boat was not going at the time, or they must have been sacrificed.

174. What upset the boat if there was no movement in the packet?—The vessel was coming up with the tide, the wherryman pulled out in spite of the tide; her own way must have upset her, she came right into the door part of the wheel.

175. The vessel was lying perfectly quiet?—Perfectly; we were going to check her round, she had some little way with the tide, but very trifling, and therefore it was the wherry pulling against us that upset her.

176. Will you inform the Committee of the next accident which happened by your vessel?—The next occurred this year, and it was stated that we had run over a vessel with a valuable cargo of East India goods; coming into the wharf at St. Catherine's, the vessel had been checked round head upon tide, and was close to the entrance of the wharf, and was dropping up stern foremost into her berth; those men in the skiff, I have no doubt, in spite of the remonstrances of the mate and the passengers, rowed into the after part of the wheel. Then came a statement in the newspaper that I had run over them.

177. What happened upon that occasion?—Nothing of consequence; there was a gun-case which was shoved into the water, and the man immediately picked it up.

178. And you were then dropping in?—Yes.

179. Was your engine moving?—No, it was still.

180. Was the same deaf man in the skiff at that time?—I do not know.

181. Was it not Lucy and his son on board that?—No, the boat belonged to Mr. Thomas Lucy, the other was a John Lucy. For the truth of what I have stated I can appeal to Sir John Hall, at St. Catherine's.

182. Will you state the third accident which happened?—The third was a barge belonging to Messrs. Oxley & Taylors, of Northfleet. The Committee must allow me to inform them, that this has been decided against the parties at the Police House, at Shadwell. According to the bye-laws and regulations of the river, those barges and vessels are not allowed to sail in the Pool: it was blowing a gale of wind right down when we left the wharf, and to avoid a coal barge, which was a-head of us, we had eased our speed, and stopped the vessel ultimately altogether. This barge, under canvass, was on the opposite side to the one we were avoiding, the captain hove about, filled his sails, and setting immediately for our wheel, where he knew he could receive no injury himself, made use of an expression which I cannot mention here, "I will make your wheel clatter." The waterman on that side of the vessel said he would strike our wheel. "Turn her astern," I said, and she was immediately turned astern, but the vessel missing our wheel, came into our vessel and stoved the vessel right into the interior, and broke both the outside and the inner ceiling of the vessel. This man, or some one in the barge with the waterman, swore at the vessel, and said, "There, I have made a port-hole for you." I had 364 passengers on board at that time; I was obliged to get all the passengers on one side, and to make a temporary repair, and then proceeded on my voyage to Ramsgate.

183. Those are the only three accidents you have had for eleven years, on your steam vessel?—Yes.

184. And in point of fact, you have had no accident when your vessel has been under weigh?—I have never had one.

185. Did you never know any vessel to be capsized by the undulation of the water made by your wheels?—I never did, if I was put to my oath.

186. Did you ever see any one swamped or filled with water?—I never did; I have heard of wherries loaded with mackarel, in the mackarel season, and with herrings in the herring season, being swamped, but they came down to the water's edge.

187. Do

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187. Do you carry carriages?—Never; we are capable of carrying them, but it is considered an inconvenience to passengers.

188. Did you ever see deeply laden vessels receive damage from the undulation of the water?—Many times they put into a barge, which is capable of carrying only 80 tons, 100.

189. Do you know the paddles which are used with a feather?—Yes.

190. If they were used, would they create so much undulation of the water?—Certainly not.

191. Did you ever see them used?—Once only.

192. Do you know whether they are approved of?—They are very liable to get out of order, the best I believe of that kind are Lieutenant Morgan's.

193. Do you ever carry horses on board your vessel?—Never.

194. Have you ever seen any vessel that does?—Yes.

195. You consider two persons per ton a proper load for your packet?—Yes.

196. Provided you commanded a vessel that carried cattle, would not you make a great difference in carrying passengers; you would not carry the same number?—Certainly not.

197. What difference would you in your judgment consider should be made?—I think that a vessel capable of carrying 200 passengers ought not to carry more than 60 horses.

198. You have stated that you allow two passengers per ton, that is supposing you carried no cattle; if you carried cattle or horses, how would you make your calculation?—I think you ought not to carry more than one horse to two tons.

199. A horse to four men?—Yes.

200. On what principle do you calculate two persons per ton as the limit?—On my own practice in carrying passengers.

201. Is it to be understood that the weight of more than two persons to a ton, renders the vessel unmanageable?—It is not on that principle, but that danger would arise from the deck being crowded too much with passengers.

202. Is that merely from the inconvenience of being unable to work the vessel?—Yes.

203. Do you recollect the number of passengers per ton, which were allowed in vessels carrying emigrants to America?—I do not; I was employed previous to the battle of Waterloo in carrying over the troops.

204. At what rate per ton were they taken over?—As many as we could stow, and the horses also.

205. Two passengers per ton being the number allowed for vessels under the circumstances you have mentioned, would not a greater proportion of passengers be permissible to a steam vessel under any circumstances?—It depends entirely on the voyage which she has to perform.

206. Suppose you had two persons to the ton, as you have described, where would you stow away from 400 to 500 people in bad weather?—You should not take so many in bad weather.

207. Does your observation apply generally, that you should not take steam vessels to sea?—No, not at all; I could carry with perfect ease in my vessel 500 people to Greenwich; I should not like to take more than 300 to Gravesend, and 150 if I had to go much further.

208. With respect to the tonnage at which vessels are measured, may not a vessel measured by one person have a really different tonnage from another which is said to be the same?—I do not think so from the manner in which they are measured by our register measurement; because their breadth and length are taken without much regard to the depth of hold.

209. You are out in your vessel at night?—Yes.

210. What is your custom about lights?—My custom would be to place a very good lantern at the foremast head; it must have a back to it, or it would intercept the sight; and one under each paddle-box.

211. Is that always done?—I always do it, and then any vessel a-head of us sees that we are coming.

212. Do you know that other vessels do it?—I saw yesterday evening five vessels in the river, and every vessel had a lantern at the mast head.

213. Is that a particular plan of your own, or is it an order from your owners?—They order me to fix lights, but I exercise my own discretion as to the manner of fixing them.

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214. Have you ever seen Higgins's revolving lights?—Yes, I have seen them tried.

215. Do you approve of them?—Yes; I think they are clever things.

216. Is there no way of creating a light with coal gas?—No, we do not; but it would be very easy to create gas. Our vessels that go to Hamburgh have it in preference to any other light.

217. What number of men have you on board your vessel?—Eight of the crew, four engineers, at least the first and second engineer, and two firemen; and eight of the crew, besides myself.

218. Do two firemen keep your fire in order?—There are three of them; the second engineer assists in feeding the furnaces; but there is a great deal of difference in vessels; my vessel is attended better by two men than some would be by three.

219. Did you ever make any experiment to see in what degree the opening of the doors would stop the vessel?—I did try it, but I did not find any effect. But we will suppose that two or three boats are coming off at Greenwich; when I ascertain that I shall be detained, I immediately call to the engineer to open the furnace doors, because as the steam will necessarily be shut off for a considerable time from the cylinders, we do not want to create steam faster than we can use it, therefore by opening all the doors we lessen the draught.

220. If you were to open all your furnace doors, could you generate steam enough to run three knots?—No, I could not.

221. In what proportion would it reduce your steam?—The draught would not be so sharp; but we could generate steam.

222. You mean by constantly feeding the furnace?—Yes.

223. It only creates a draught by shutting?—Yes.

224. Does not the door increase the draught, and thereby the heat of the furnace?—Yes.

225. Then, of course, it must generate steam faster?—Yes.

226. In regulating the quantity of steam by the furnace doors, it must depend upon the quantity of fuel you apply?—It is necessary to shut those doors to ignite the coal the quicker.

227. Suppose you were to fill your grate with coals, and suppose you were to keep the furnace doors open, would you still be able to create steam enough to go on?—I think so, when they have been once well alight.

228. You would be much longer in getting the steam up?—Yes; I find after having stopped about 15 minutes, and taken in passengers and baggages, the moment the engineers are ordered to go on again there is no want of steam.

229. You do not get your full speed?—We are at full speed in one minute, there are an immense quantity of coals ignited in our furnaces.

230. You stated that you received a violent blow from a barge; if that had made you sink, what means had you of relieving the vessel?—I should put all my passengers off.

231. If that had happened in open sea, what should you have done?—We can discharge immense quantities of water by our pumps. I once met with an accident from a ship's anchor, which pricked a hole completely through the body of the vessel, and we came from Folkestone to Ramsgate Water as fast as we could, and we supplied the boiler with water from the crack till we came up to Ramsgate.

232. To the extent of feeding your boilers you could use the engine-pump?—Beyond that; because while the engine is supplied we have brass plungers to our pumps, which would displace at every stroke, I think, a gallon and a half of water to every stroke, and they perform to every stroke; it is nearly 100 gallons a minute that we can throw overboard, and not stop our speed.

233. In the event of your not being able to relieve yourself of water, might not this circumstance occur, that by increasing the water it would rise, not as in an ordinary vessel where no harm would arise till it had got many feet, but if it rose to any height it would affect your fire and your coals?—Certainly, it depends upon the build of her; my vessel is a flat-bottomed vessel, but then flat bottomed vessels have an immense floor, and contain a vast quantity of water before it rises over the timbers; but in vessels it would be an immense while before it reached the fire.

234. How far would it be before it came to the fire?—It must rise four feet and a half; I should think that our furnace bars are about four feet.

235. Could you get your coals?—We should have no difficulty in that.

236. You think you can discharge 100 gallons a minute?—Yes.

237. What

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237. What means have you of preventing fire?—We have the same pumps to throw water, and we have all the pumps on the vessel's sides to draw water; but as boilers are at present constructed it is impossible for them while they have water round them to set fire to any thing; they are encircled with water.

238. Assuming that a fire happens near the engines in a vessel before it is discovered, what means would there be of putting it out beyond the hand-buckets?—None whatever.

239. What is the greatest speed that you yourself have gone in your vessel at any time?—Barely ten knots.

240. Without particularizing any other, what is the greatest speed you have known any others go at?—I do not think any of them exceed ten knots and a half.

241. Have any of the engines high pressure on them?—None, that I am aware, except a French vessel at Dover.

242. There is an Act of Parliament against it?—I believe there is.

243. What is the danger of two vessels racing where there is fair way, admitting that they do not run foul of each other?—There is no particular danger if the engineer is careful; but if the engineer allows himself to be excited by the circumstance and overloads the furnace bars, he may do harm in that way. There is no fear of the boilers bursting but from the intense heat of the fires; the water is consumed so fast that there has been instances where they have allowed it to get too low in the boiler; then, in that case, it is composed of nothing but froth and steam in the boiler; the plates of the boiler become red hot and close together.

244. But there is no danger of the boilers bursting?—Not with those boilers.

245. During the 11 years that you have commanded this steam boat has any accident happened to your boat from the velocity of its going?—Not one.

246. Suppose you had commanded a sailing vessel of the same size and of the same tonnage, would there in all probability have been fewer accidents or more?—I commanded a sailing vessel for five years from Ostend, Ramsgate and other parts, and I am sure that I unavoidably met with more accidents in the Pool than I have done with steam vessels; because we, under canvass, turn backward and forward, but the watermen never ran a-head of us, they knew we had no power to stop them.

247. Then the chances would have been that if you had commanded a sailing vessel instead of a steam vessel you would have met with more accidents?—I am quite sure of it.

248. Does the swell occasioned by a steam boat arise from the velocity of its going, from the size of the boat, or from the quantity of matter which the boat contains?—The swell arises from the quantity of resistance opposed by the body of the vessel to the water. There are, for instance, vessels navigating the Pool that take in cargoes of 80 or 100 tons of goods, and they require a great deal of action on the part of the fans to make speed, but they would make less undulation than going at half speed.

249. Then it does not arise entirely from the speed of the vessel's going?—It arises from the quantity of matter.

250. If she were to go ten knots in the river she would not make the same undulation as if she were to go only six?—No.

251. Supposing that your vessel is going at the rate of six knots an hour, and you put the utmost speed at which you can go, is there any material difference between the undulation occasioned by the speed in going six knots an hour and in going ten?—There is more undulation at ten knots.

252. Supposing you are going nearly at full speed, and another vessel of half her size is going at half speed, which will occasion the greatest swell?—She would, because she displaces a greater body of water with the fans of her wheel, and she requires more driving through it.

253. Then your opinion is, that the great swell arises more from the quantity of water than from the speed at which she is going?—Certainly.

254. Have you ever watched to see from what part of the vessel's side the swell goes?—I have.

255. Where do you find it?—I should say that it goes at an angle of about 23 degrees from the vessel's side.

256. Have you ever been in a steam-boat in a very narrow channel between two banks?—Yes; I went into the river Lea, at Blackwall.

257. Have you ever observed that the swell is considerably in advance of the steam-boat?—Not if you continue to go on.

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258. In passing vessels have you any regulation at all as to keeping sides?—We have no decided regulation of that kind. It is so easy for vessels to avoid if they see each other; you see which side of the vessel is open, and you go that side of her, because it is easy to go that side. We have this rule in the river; the steam-boat that is going against tide keeps that side of the river where the tide is weakest; the other vessel keeps with the tide.

259. And therefore they cross from side to side as they find it convenient?—Yes.

259*. In a dark night as you can have no particular rule similar to what you have stated occurs in the day, what do you do?—We have no established regulation. I do think that it would be a good thing to have a regulation of that kind.

260. Do you come up on a dark night?—Yes, and we always order the lights, and come up very easy. The Pool at this moment is not 150 feet wide.

261. Supposing that a plan were adopted with respect to all vessels coming up the river, and to all vessels going down the river, that there should be three lights horizontal in the one case, and three lights perpendicular in the other; namely, three lights horizontal for vessels going down, and three lights perpendicular for vessels coming up, do you not think that that would be very convenient?—I should say that it would be very much so.

262. Do you see any necessity for a change of form with respect to the manner in which the lights should be placed; if the lights were placed on the fore part of the vessel, they would know whether it was coming up or down?—I think any regulation of that sort would be beneficial.

263. At sea if all vessels coming northward were to have the one row of lights, and the others *vice versa*, you think that would be beneficial?—Yes.

264. Will you describe to the Committee why you think that form would be necessary?—That or any other form, admitting it were understood; the form of the lights would be immaterial.

265. Some such mode, up the river one way, and another the other way, would be beneficial?—Yes.

266. You consider that night signals would be beneficial?—Yes.

267. Does any steam boat go at night with the light at the stern?—Two of them, they do not take the pains to mast it.

268. Then you think that would be beneficial?—Yes, for suppose I was going down the river, then the signal would be three lights horizontal, and I say I have nothing to fear from that man; and then I see a vessel with three lights perpendicular, and I know the man is coming the other way. The form of the lights is immaterial.

269. Is there anything that you would suggest, any sort of signal by lights preferable to that which is now adopted?—No, I think the suggestion would be a very great improvement; the more simple signals are, the better.

270. From your experience, having navigated the Pool for 11 years, do you conceive that the chance of avoiding accidents would be greater if your speed was limited by Act of Parliament to six knots an hour, or if it was left at your own discretion to go at what speed you please?—If the speed of steam boats was not decreased below six knots an hour, I think it would be an improvement.

271. Is it more likely that accidents would occur by making a legislative enactment on the subject, or by leaving it to the discretion of the captains?—It would depend upon the discretion of the captain, and I should like to have a discretionary power; I do not think there would be more danger, I think there would be less, by having it in my own discretion.

272. While that is your opinion from your competence of your own discretion, do you not think, as a measure of general policy to the public, that it would be desirable that there should be a regulation, provided they were not limited to less than five or six knots an hour?—I should think so, if they were not carried too low.

273. If a regulation was made that the vessels were only to go at six knots an hour, might not cases very often arise in which they might be put into danger, by not going faster?—They might arise. If I were asked the question candidly, whether it was my opinion that the steam vessels at present navigating the Pool should be allowed to come into it, or to be put out of it, I should say that it would be better for them to be put out of it, because the mischief to property is unavoidable, the whole of our coasting trade would be done by steam in seven years.

274. You stated, that in 30 seconds you could stop your steam-boat before she went much more than half her own length; at what rate do you calculate the vessel

to

to be going?—At full speed; I put Lord Fitzroy Somerset out of my vessel in 30 seconds, he wished to ascertain in what time it could be done.

275. Supposing it was a regulation that steam-boats in the Pool should not exceed six knots in the Pool, could you stop your steam-boats at a shorter distance than when she was going nine or ten?—No, I think not; the immense surface the fans oppose to the water is so instantaneous, that as the vessel is going quicker they oppose an immense quantity of water; the faster a vessel is going they will throw up more water.

276. Then it would be quite the same, with respect to stopping a vessel, whether you were going ten knots or six knots an hour?—Yes.

277. The Committee understand that with all the inconveniences and disadvantages connected with steam, you still think that there would be quite as many accidents happen with vessels in the ordinary way?—Yes, I am quite sure of it; when Ramsgate had packets to London, we used to come in with all the canvass we could carry; you never then saw the watermen rowing up to the middle of the Pool, because they knew they had not the power to stop, and I do mean to say that there was more damage done to craft than there is now.

Mr. Thomas Lucy, called in; and Examined.

278. YOU are a lighterman?—Yes, in partnership with my brother.

279. At Cock's Quay?—At Cock's Quay.

280. Have you met with any accident at any time?—With several.

281. Will you mention the facts of the case in the accident which happened to you from Captain Martin?—The vessel which Captain Martin mentioned just now, was a skiff, loaded with ten bales of East India goods, with two other cases besides; it was rather a particular order, and to give all the expedition that could be given to it, I went down with this boat myself. In rowing by St. Catherine's Dock there was a steam-boat going by, we pulled quickly to get out, and The City of London was coming in without any rope to stop her progress; we were going against the tide, and we always avoid going out in the tide, and keep as near shore as we can; I hailed her to keep off; I saw the danger, which was very imminent; there were from forty to sixty persons upon the pier-head hailing the steam-boat at the same time to keep off; instead of that, the steam-boat still kept coming in; when they found the danger so imminent, I was underneath the paddle-box; the St. Catherine's Dock gates, the sluices being up, caused the water to flow out very quickly, and drove me alongside the steam-boat, the passengers all seeing the danger, and the wheels kept going on; I missed my son, who had got under the eddy sheets, and thought he was cut in half by the wheel. They knocked one case overboard, which I picked up myself, and the water was level with the skiff's gunwale, and coming over at one time. The passengers moved to the opposite side to clear, and I extricated the skiff, and got alongside the paddle-box. I spoke to Captain Martin, and said I thought it was very imprudent his coming along in that manner, whereby my life was in danger and my son's too. The answer I got was that the boat was well insured and I had come to have her sunk, and I should get well paid for my trouble. All the cargoes with which we are loaded we are responsible for.

282. Then in fact they were not insured?—No; it will be also understood that if the goods are insured, which we should have under our trust, the underwriters come upon us in case of any accident.

283. Did this accident occur near the entrance of St. Catherine's?—Close to the entrance, within twenty yards of the gates.

284. Was the steam vessel going forward?—Coming in.

285. Was not the ship being reversed into the dock?—She was going to her moorings into the dock.

286. Was not her stern going first?—No, she came directly in.

287. Was the action of the paddles reversed?—Yes.

288. Then she was stern foremost?—No, she was stopping her way.

289. Would your wherry have come against the steam-boat, if it had not been for the tide driving you out?—Yes, it would.

290. You evidently saw that the object of the steam vessel was to get into the docks?—Yes.

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291. And

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291. And you kept on in the same direction?—Yes, but I was quite out of the way, where the ship had no business to be, it was the entrance of the dock, whereas where it generally stopped was at a wharf down below; that was occasioned by not having the ropes out. I found that that was occasioned by the negligence of the person who ought to have attended to them.

292. Do not you think that you placed yourself in danger, rather than that the steam vessel ran against you?—No.

293. You have stated in your evidence that it was the water of the floodgates that drove you against the steam-boat?—Yes, partly.

294. You have stated the rush of the water drove you against the boat?—It drove me further out.

295. How could the steam boat avoid you if you ran against her?—By keeping out.

296. You say there was a rush of water from the dock, and this rush of water drove you against the boat. If you had been captain of the steam vessel, how would you have acted to prevent this accident happening?—To have kept her off.

297. Was she not backing at that time?—She was backing.

298. The danger arose partly from the flood of water?—Yes, but The City of London at that time was where I never saw it at any time before.

299. To what, if any, misconduct do you attribute this accident?—To the captain's own misconduct.

300. You complain that this steam-boat not going into the proper wharf occasioned this accident?—Yes.

301. To what misconduct do you attribute this accident?—To not having ropes out, which they ought to have had, and which they all have.

302. Was this vessel coming with any particular velocity?—Yes, she came right in.

303. Had she not her paddles turned?—Yes, she had; after the passengers ran on the opposite side they reversed those wheels.

304. If her wheels were reversed, how could she go with any velocity?—By keeping the way upon her; the ships have considerable way upon them, even after they stop their wheels.

305. At what velocity was she going?—She was coming at the rate of eight knots, 20 yards from the jetty-head; if they had had ropes they would not have come to that point at all; they have ropes to the tier below, and that is to avoid all kind of danger to vessels close in shore in that part.

306. Then you conceive that the vessel ought to have stopped short of the place at which she did actually stop?—Yes.

307. Supposing that had been a sailing vessel, might not the same accident have happened had she been going into her moorings?—No, because she would not have had the way upon her.

308. Why would she not have had the way upon her?—Because the vessel would have dropped up instead of running down with the tide.

309. Which way was the vessel's head at the time the accident happened?—Direct in with the shore.

310. Did the steam vessel turn her head towards the docks suddenly?—She came direct into the tier where I was.

311. Was it very sudden?—Yes, very sudden; but quite sufficient to have backed her outside wheels to have kept them off from me.

312. To what distance from the dock did she come?—Ten, or 15 or 20 yards.

313. Then was there not space enough to keep you away from the vessel?—No, on account of the suddenness of the vessel's coming.

314. Would not the vessel coming to you drive you away?—No, the vessel coming would draw the boat towards her.

315. Are the Committee to understand, that a vessel approaching another would draw the other nearer to it?—On a steam-boat it would.

316. You attribute this to the neglect of the captain?—Yes.

317. And nothing else?—And nothing else.

318. If he had stopped no accident would have happened?—None.

319. This was an accident which the captain had it in his power to prevent?—Yes.

320. It was not a necessary consequence of its being a steam-boat?—No; I have had them run on board of me with a 50-ton lighter. This was the Albion. I was coming up with 50 puncheons of rum, and the Albion was a great distance astern of me; I hailed them to keep to the southward, as I was well to the northward, to keep

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keep clear of me ; instead of that, he ran into the stern of the lighter, and completely knocked her up ; but they always pay us damages.

321. Was the steam-boat in your stern?—Yes, the steam-boat was half a mile from me ; as soon as I saw them I hailed them.

322. Was there space enough to go round?—Yes.

323. Where was this?—At Hanover Hole.

324. Did this accident arise from the neglect of the captain?—Yes.

325. He might have prevented it?—He might have prevented it ; but he told me that if he did not run into me, he must have run into the tier, and my accident was the least expense.

326. Was there not room sufficient for him to pass?—Plenty of room : they ran a boat down last week.

327. Do you know that?—I do.

328. Did you see this accident yourself?—I was in the lighter myself.

329. Would not the same accident have happened with a sailing packet?—No ; because she would not have come with the same velocity.

330. How many knots an hour was she coming?—Ten knots.

331. The captain could, if she had been properly managed, have turned out of the way, and done you no injury?—Yes.

332. Do you attribute this to the wilful running down, or to the neglect of the pilot?—To wilful running down, I should think, because he could have avoided it ; it must have been wilful.

333. Did that accident arise from the use of the steam?—Quite so, from the velocity.

334. You have stated that this accident happened through the neglect of the captain ; if a sailing vessel had been managed in the same manner, would not the same accident have happened?—Certainly not.

335. What part of your craft did she hit?—The stern ; she was a new lighter too.

336. Did she do herself much damage?—Yes, she started her stern, and did herself much mischief.

337. How do you reconcile the answer of the captain with your opinion that there was room for him to pass?—He said he was driven to do that or obliged to go into the tier, and that he thought that by going into the tier he should have done himself greater injury.

338. Has this been decided in a court of law?—No, they paid all the expenses without going to law.

339. Are there any other cases which have happened?—Many that I have witnessed.

340. State to the Committee any that you have seen?—I had a craft of 30 tons of sugar which was almost sunk ; it was lying at Prince's Stairs ; there were four steam-boats coming down then, one after the other, racing I suppose ; the water completely washed over the vessel's stern, at least 10 feet high ; it came direct over the vessel's bows right on the stern, the swell.

341. Was she afloat at the time?—Afloat ; it came fairly over her. We had the sugars away, but we found that there was no damage because they were covered.

342. How many tons is your vessel?—Forty tons ; and it was a foot and a half from the water's edge.

343. What means had you of knowing it was 10 feet high?—From the height of the vessel ; the captains came to witness it, they said that they had never witnessed such a surge before.

344. Whereabouts did this happen?—At Prince's Stairs, Rotherhithe.

345. How broad is the river there?—Seven hundred yards ; we were lying between the tiers.

346. What do you conceive to have been the entire space free from vessels at the time that this great surge was raised?—Half the river.

347. What space should you suppose that to have been?—Three hundred and fifty yards ; perhaps it might not be so much as that ; it is not always the same, because there are not always so many ships in the tier.

348. Had one vessel only come down, would she have produced the same effect upon the water?—No, it was on account of the racing ; one boat alone would not have done it.

349. Was one boat behind the other?—Two were close together, one was 10 yards astern, and the other behind.

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350. Then

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350. Then you think it was on account of the racing that this undulation was produced, and that one vessel would not have done it?—Yes.

351. Have you seen any damage to the malt vessels and to the corn vessels?—No, I have not.

352. Are the Committee to understand you to state that when one vessel goes alone she does not make that disturbance in the river, and that it is from three or four going that that effect is produced?—One going makes great disturbance in the water, but not so much as three or four; the number coming increased the swell very much.

353. Was the vessel that raised this great surf the first or last?—The first commenced it, certainly.

354. Which was the vessel that did you the mischief?—We thought it was the whole.

355. How many seas will be made by a steam vessel?—Ten to 15 or 20.

356. How long will that last?—Full five minutes.

357. Then unless vessels were five minutes behind each other you would come into the difficulty you speak of?—Yes.

358. You say you have seen wherries swamped, have you ever been present when lives have been lost?—No.

359. Have you ever seen vessels and boats turned up bottom upwards?—Yes, I saw one.

360. Was that the effect of one boat or of four?—Of one.

361. Would you explain the situation where that was?—It was at Duke's Shore.

362. Was she lying at the wharf?—Lying on the shore; the bow of the wherry on the shore, waiting to take passengers over.

363. And there was nothing happened but the boat going by to produce the effect you speak of?—The swell of the boat drew the wherry down.

364. The boat was nearly afloat?—Yes.

365. The swell of the water brought her entirely afloat?—Yes.

366. And then the next sea upset her?—Yes.

367. Did you take particular notice of this circumstance?—Yes.

368. How far were you from her?—I was half way over the water.

369. Did the owner receive any compensation?—I do not know.

370. Do you know the name of the vessel?—No.

371. Was it a large or a small one?—It was one of the Gravesend boats. We consider the small boats to make more swell than the larger ones, and these are much smaller.

372. The swamping of wherries is a very common thing, is not it?—Yes.

373. Happening every day?—Yes.

374. From what cause?—From steam-boats. On a Saturday morning after nine o'clock there will be six or seven running down one after another.

375. Are there any other cases which you can mention to the Committee of accidents from steam vessels?—Only where we have had several loaded craft swamped.

376. Has it ever come under your knowledge or observation that persons have thrown their boats in the way of steam vessels in order to have them sunk?—No.

377. You never heard of such a thing?—No.

378. Has more caution been observed lately than before?—There has.

379. Is there any difference between the build of wherries below bridge and above bridge?—Not that I am aware of.

380. Are not those below bridge built deeper than those above bridge?—Yes; they are generally.

381. Do you think that a vessel would have capsized at Deptford?—No, not without she went athwart a tier.

382. Do you think if the boats about London were built like the Deptford boats they would be liable to this injury?—They ought to be.

383. They would not draw so fast?—No.

384. You think a ship's jolly-boat would suffer no injury?—No. It is an injury we sustain every day.

385. Inform the Committee of any other cases of the same kind which have occurred?—Loaded craft lying between tiers. I have had a lighter in the course of one night rub a hole into the walls of the lighters for an inch, with the bolts of the vessel, from the agitation of the vessel.

386. In such cases are not fenders used?—We never did use them before.

387. You

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387. You are accustomed to lay your lighters all together, without using fenders at all?—Yes.

388. You do not use fenders?—In going up and down the river we do.

389. Have the vessels in passing lights?—Yes. Sometimes they have not.

390. Is there such a thing as a bell on board?—Yes, but they never make use of them.

391. Is it a bell like those in all other ships?—Yes.

392. Do not you think it would be a good arrangement to have a bell?—Yes, the Irish and Scotch steam-boats always use them.

393. You say there are five or six wherries swamped in a week, and yet you only know of one?—Only one.

394. Can you tell the Committee any others that have come within your observation?—I do not know of any others.

395. And you are now speaking of a space of five years?—Yes, that was the time of the first accident we had.

396. When was the last?—The 15th of July this year.

397. Do you recollect when the first steam-boat came on the Thames?—Yes.

398. You were in the habit of carrying goods?—Yes.

399. Did any accident happen to you?—Yes, we have had accidents happen.

400. By your own men's neglect, and the neglect of others?—Yes.

401. More from the neglect of others than from your own men?—I do not know that.

402. What kind of accidents do you mean?—Such as craft sinking from blows which we received from other vessels.

403. That arose from your men not getting out of the way?—Yes.

404. Did you not sustain an equal number of accidents in the five years previously to the steam-boats?—No.

405. Do you remember, prior to steam boats being used, any accident?—We had only one, of barley-sugar; we had some hanging up and getting foul on piles.

406. Did the sailing vessel run on board your barge?—Yes.

407. By whose neglect was that occasioned?—Our men's neglect, not getting out of the way.

408. How could your barge get out of the way, have you any means of directing it?—Yes we have.

409. How many men have you on board your barge?—Two.

410. How many ton?—Thirty ton.

411. At what rate of speed could you move a barge of that kind?—I should think three knots with the tide. It depends upon whether they are loaded or light.

412. What should you do on slack water?—We should remain stationary.

413. Can you move in still water?—We can move in still water.

414. At what rate?—I cannot say.

415. In the accident which you mention did the vessel come against your broadside?—Yes.

416. And she struck you?—Yes.

417. If that had been a steam vessel it could have stopped, and the accident would not have occurred?—If they had chosen to have done it.

418. Do not you think, supposing steam vessels to continue to navigate the Pool, and they take care not to run foul of vessels, they may keep clear of accidents?—I do not think they can, from the rate they go at.

419. Supposing it was reduced to six knots an hour, do not you think they might keep clear of accidents?—No, if it was a crowded Pool.

420. Against tide?—That would be the same, because they may easily put on more power.

421. Then they must increase the speed?—They have no occasion to increase the speed.

422. If the tide is running five knots an hour would you go a-head or astern?—She would go a-head of us.

423. How would that be?—Because she was going faster than us.

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Captain *Basil Hall*, called in; and Examined.

Captain *Basil Hall*.

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424. IN a publication of yours lately the Committee observe that you state, that in America the steam-boats are now steered by a man on the forecastle; the Committee would be obliged if you would state if that be the case, and how it is so managed, and the degree of facility with which the wheel moves the tiller, as compared with the present system of having the wheel close aft?—I can say, generally, that I never observed any greater difficulty in steering a steam-boat in the bows than in the stern. In America all the steam-boats, I may remark, are confined to rivers, or almost all; there is not one in 300 or 500 that ever goes into salt water, or ever is out of smooth water. One of the practical results of that is, that they are enabled to extend the deck for sometimes eight or ten feet on each side, upon what they call a gear, and upon this to build up immense houses upon the deck, so that they look like large castles upon the water. I have been upon one, the deck of which was 30 feet above the level of the river, upon which there was this building; the consequence of that, every nautical man will perceive, is, that you must remove the steersman from the ordinary place, because he cannot see before him. What the progress of the invention has been I do not know. The result is, that upon all those steam-boats, far forward in the bows, upon the top of this house, there is a scaffolding erected, and there the wheel is placed.

425. Before the foremast?—Never so far from the cutwater as the end of this room, but generally about a fifth of the vessel's own length from the bows, and fully the height of this room.

426. Just before the foremast?—They have no mast, none at all; and the custom on the river where the steam navigation is brought to the greatest perfection, the Mississippi, (and I believe it is almost a law now), is, that the pilot should always steer the boat; if he is tired, or wishes to go down, the other pilot comes up; which I mention to show that the fatigue is not so great, because those boats merely stop for wood three or four times a day, and yet no man touches the wheel but those two pilots during the whole voyage.

427. Of course he can therefore see immediately before the steam vessel, to avoid any pieces of wood or anything in his way?—One of the greatest advantages of his standing on this place is, that he commands a view which reaches near the vessel. A line produced from his eye to the top of the steam vessel would meet the water within six or eight feet of the cutwater; that is quite near enough. They have always a little bowsprit, about twelve feet long, for this purpose I believe, only to assist in the steerage. The man is so far forward that he cannot perceive the ship answering her helm so soon as when he stands abaft; the consequence of which is that they are obliged to have a bowsprit, upon which they raise a small slender mast, upon the top of this they have a black globe, which you can perceive against the sky in the darkest night, or amongst the trees, and the moment the ship begins to answer her helm, you see this spar or globe moving a little: I could very easily submit to the Committee drawings of all these which I am now describing.

428. Will you be so good as to describe the mode in which the ropes act?—A few words will describe that: the tiller is generally abaft the rudder, so as entirely to detach it from the vessel.

429. Long or short?—Not very long. I should not say that I have seen more than six feet; I have very seldom seen the whole machinery so much hid. The tiller ropes, I may mention, almost invariably I think I may say, are Manilla rope, a white rope, very strong, and wears well. The thickness of the rope would depend upon the vessel: the small rope is two and a half in circumference; I should think I have never seen one above three.

430. Upon the average, what size of vessel are you speaking of; 300 tons?—More; 400 tons probably they call them. The tiller ropes are always laid outside the boat

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boat all together in trunks, covered trunks, capable of being opened anywhere, over fair leaders in trunks, so that the friction is extremely small. The tiller rope, when it comes as far forward as the wheel, passes through a block or a sheave in the side of the vessel, and is led to the barrel of the wheel in the usual way.

431. Is it not borne out in the quarter by a piece of wood, to make a greater angle with the tiller?—I never saw it.

432. Does it come straight along?—Yes, it goes to the quarter; the geards of these boats swell them out so much that they have always a considerable width, and I have seen some of the boats in which the tiller rope was doubled abaft. There are various modes of gaining power, but, generally speaking, there is a single rope, and when I moved the wheel myself, I found it move with perfect facility. I had to use a little entreaty to prevail upon the pilot to allow me to do it; but I said that I wished to satisfy myself that a vessel of that kind might be moved with equal facility to the other, and I have steered them for an hour at a time, and with no perceivable difference whatever, and, generally speaking, with greater facility, in consequence of their having the barrel of the wheel very small. The pilots and people there consider it of great importance that one man should be able to move the wheel. I have seen another man placed at the wheel, but, generally speaking, it is considered to be of importance that one man should be so placed that he should communicate the impulse he wishes to give, that the object he sees should be evaded by one man.

433. Do you happen to recollect what was the length of the vessel you steered yourself?—I have memorandums of that; but I dare say between 100 and 120 feet at least, and deeply laden; they have them going up the Mississippi; they are very deeply laden, so much so that they are obliged to reduce the diameter of the paddle.

434. What water did the boat draw?—They have a great variety; this was obliged to go up the Ohio, and was very deep; but I should think the maximum draught of this was not above seven feet. I have seen a boat on the Ohio of 120 feet, and between 300 and 400 tons, that did not draw two feet, but then she was flat bottomed.

435. Are not most of them flat bottomed?—I know that the difference between the draught of water in the vessel I was in was between two and three feet.

436. She was loaded to her maximum?—Yes; and going certainly between 10 and 12 knots at least; at her maximum speed I presume that she would go 12 knots, or 13 miles.

437. Did you satisfy yourself upon that point?—I never tried actual experiments, but I took pains to ascertain the whole distance, and I should think the maximum speed was 12 knots.

438. Have they high pressure?—Not all, but a good many; this boat had 80 pounds upon the square inch; five boilers on deck. I may state one circumstance, that the whole machinery, the boilers, and every thing inclusive, in all the vessels that I saw is upon deck; they have none of their apparatus below wheel; the boilers, furnace, machinery, and every thing is upon deck.

439. And something built over it, to protect it against the weather?—Yes, this great house; but the working beam and some other parts of the machinery are exposed.

440. How do they regulate the speed of their vessels, when they wish to go under half speed for instance; do they ever moderate their speed?—They reduce the pressure of the steam.

441. By letting the steam off?—By letting the steam off in those high pressure boats, certainly.

442. Do they seem to do that with great command?—Yes, they have very considerable command; they have not in America a plan that is common in the Canada boats on the St. Lawrence, of unlocking the paddles; they throw them out a gear; the axle is fixed by a coupling-box, and they throw them out a gear. Our boats have not that plan, and when they stop at any wood station the coupling-boxes are withdrawn, and the paddle wheel is allowed to go round. It varies very much with respect to the pressure. I have seen them, when they have been running races, loading the safety valve very much. I have seen a man put his foot upon the safety valve; but that will happen in any country.

443. Would you favour the Committee with any observations which you think might tend to give them information in any regulation that it might be important to make with regard to steam-boats in this country?—I should certainly be very anxious to

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see the principle of steering forward introduced into river boats; and I should like also to see a mode that has been long in use in this country, as I dare say some of the Committee have seen upon the Tay, of regulating the whole of the machinery by a hand gear upon the deck. In the boats on the Tay, the boats that go from Perth to Dundee and backwards and forwards, the machinery is so fitted that a spindle comes up upon the deck, and is furnished with a horizontal handle and a dial plate, and with a hand like the hand of a clock, and on this dial-plate there is "a-head," "a-stern," and "stop," and anybody, under the direction of the captain, can turn it, so that when the handle turns to stop, the machinery stops; when a-head, it goes on; or back, it goes back with the greatest facility; the value of which is, that the movements may be regulated without calling down to the engineer, which may be mistaken, and time may be lost; and what I should like to see is, that this hand gear should be in all river boats and near the wheel, so that a man, seeing the impediments in the way, should stop the boat or send her a-head.

444. Do you recollect what number it is?—No; but I will send information to the Committee; it was invented by Messrs. Carmichael, of Dundee, and I wonder it has not been followed more.

445. Have you seen it in use?—Yes; I was going to mention a circumstance to show how completely it might be done. The gentlemen of the Dundee ferry were kind enough to lend me the steam-boat, in order to try experiments of steering her head and stern: I was in the boat six hours, and I was six hours constantly employed; the machinery must have been stopped and set a-head 60 times; the door of the engine-room was never once unlocked; the whole of the operations were performed upon deck; a seaman did it, and not an engineer; an engineer was there, but the reference to the engineer was not necessary.

446. You moved the machinery if you wanted it to turn a-stern?—Yes; I have written a pamphlet upon the subject, which, if the Committee will allow me, I will send them. There is another idea that has occurred to me, of great importance, and not an unusual subject for legislation, which is, that a man who commands a steam-boat should be required to know something about steam machinery; we require a captain of a vessel to know something about navigation and the discipline, and if he is found wanting in any one of these, the person who takes passages may call upon him to answer upon those points. We consider that a captain should know how to strap a block, and so on, and although he would be very awkward in doing it, and I should not require him to do it without a little practice, still he ought to know how it should be done; and it has often occurred to me that it would be reasonable that the captain of the vessel should know how to direct his boat, and not to be under his engineer, as I have seen many captains under the engineer. I believe that was the regulation of the Leith and Edinburgh Steam Company, in which James Watt and Soho were, that the captains were required to know something about the engine.

447. Are there any regulations on the rivers in America as to the lights that should be carried in steam-boats at nights, when it is dark?—None that I know of; but I believe that every steam-boat in America does carry a light under her bowsprit; I think a single light. It is certainly very low down. I never met a steam-boat in America that had not a light low down; that is my impression decidedly. Perhaps it may be right to mention why it is so; the helmsman being forward, if there was a light so near him, it would prevent his steering; it is a great object in steering that the helmsman should have no light in his eyes.

448. They might put it over his head?—They might; but I think it is always low down; and there is one source of great brilliancy in all the American boats, that the boilers being upon deck, the place in which they are fed is forward, and is immediately under where the helmsman stands: he stands immediately over the furnaces; they are supplied with wood by a large quantity of negroes, who are constantly pitching in wood.

449. Do you recollect whence the wood is supplied for the furnaces?—In the fore part of the vessel; all the wood is pitched from thence into the furnaces under the boilers.

450. Do you conceive that the height on which the steersman stands in those vessels is essential?—Quite so, for various reasons.

451. Height being essential, do you think that this mode of steering the vessel from the bows would be applicable to vessels in this country, which have masts, and which are liable to go to sea?—That question will require a double answer. I would say that

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that vessels having no high place, as those boats have, would require, I conceive, to do justice to the principle, a scaffolding, a light scaffolding, sufficient to hold two men, the pilot and steersman; that it ought to be high, that he may see buoys and boats that are near him. For sea purposes the helmsman need not be in the bow of the vessel, because there is no obstacle which may not be seen in sufficient time by look-out men, who will apprise the helmsman; and also in bad weather at sea, unless the platform was very high indeed, the helmsman would be exposed to the wash of the sea needlessly; and I should also say that at sea, where sails are used, the proper place for the helmsman is abaft, and there is the proper place for the captain to be, to look at the sails and to see the vessel; and there also the helmsman ought to be; and I conceive there would be no difficulty in having two sets of tiller ropes and two wheels, which are not expensive, one for sea purposes, and one for the river; and there might be two tillers, or the tiller ropes might be made with hooks. Any practical man would invent a mode in ten minutes, without expense or difficulty; but there has been no complaint of any difficulty of steering at sea, and therefore the remarks that I have made have been with respect to a crowded river.

452. Steam vessels are frequently used with sails in our harbours, and in some rivers this application of steerage would involve the necessity of not using those sails before the foremast?—In answer to that question, I should say that the platform that I propose should be a little before the foremast, and might be out of the reach of the foremast. I conceive that there would be no practical difficulty; if they came to a narrow navigation, they would haul down the sail; it is not so essential to a steam-boat.

453. Would you describe the mode in which the rope, after passing the quarters of the vessel, is communicated with the tiller?—I cannot do it further than the words I used formerly; in the usual way.

454. Is that the usual way?—Yes; there is nothing peculiar about that; I would say now that the boats have as frequently the tillers shipped in the usual way as shipped abaft the rudder.

455. Is any of this rope exposed in passing from the sides of the ship to the tiller?—Sometimes it is, certainly.

456. Must it not necessarily be?—It is in all vessels without exception. I never saw it, except in a line-of-battle ship, where the wheel is under the poop.

457. Is not it a very common mode to have a lever inside the vessel, so that the action of the power shall be inside the vessel?—Surely, that is the usual way.

458. When the tiller rope is on board, does it pass outside or inside?—Always outside, though the tiller is inside, and is kept clear of the passengers.

459. Covered by a sort of trunk?—Yes, and to protect it from clothes being hung upon it.

460. Opening every where?—Yes.

461. Then when the rope comes outside it must be exposed?—No, it goes in a trunk. I have seen it exposed sometimes, but they must have access to it to lead it along; it would be difficult to put it through.

462. In America, or elsewhere in the parts which you have visited, have you met with anything at all parallel to the navigation of the River Thames in the Pool?—I should think that at New York, at certain crowded seasons, it is not unlike it; some parts of it; seldom so crowded as the Thames.

463. You have of course been through the Pool lately?—I have frequently been through it in steam-boats; I have not seen much resembling it.

464. Has anything occurred to you for the prevention of accident there?—I think the best way to prevent accidents is to let people get out of the way; I would punish any steam-boat that would go out of her way to do mischief, precisely as I would punish a sailing vessel that should run over a boat wantonly without hauling in stays, or jamming herself into a place where a boat could not row out of the way; but I have never seen any accident of steam-boats that I think could be prevented by legislation.

465. In passing through the Pool, have you seen the swell occasioned by the steam-boats?—Yes; I have been in wherries, and insisted upon the fellows that they should keep back, and it never occurred to me that if I was swamped I should receive any compensation.

466. Then you think that the accidents have arisen from wherries not keeping out of the way?—They have arisen from natural circumstances following from this new invention, and which I fear are incident to that invention itself, and I do

Captain Basil Hall. not see how you can prevent it without checking the progress of the invention: I have seen none.

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467. As to matter of possibility, if you check, when they come into this crowded part of the river, the rapidity of the steam-boats, will not that reduce the difficulty of a wherry getting out of its way; and by diminishing the swell, will not you reduce the danger to smaller vessels?—Yes, I think that is a fair way. I will admit, when you come to such a place as that, which is a very small portion of her voyage, and must be immaterial to the eventual length of the voyage, although it may be of consequence when two boats are running against each other; if it is possible, I think it is abundantly reasonable that at that particular point, which should be particularly defined, their speed should be reduced.

468. You think this would very much lessen the difficulty?—I would say that it would demolish the difficulty altogether, if you could accomplish it; if you could manage to oblige these steam-boats to go at the rate of two or three knots when they come to the Pool, there would be no wave of any importance; but the accidents that I have seen arose, I think, from want of sufficient precaution. It is quite obvious that if you check the speed at a certain point, you diminish the swell.

469. You have stated that there are five boilers on the deck of these American vessels?—Generally.

470. Are they all at work at the same time?—Yes, all fiercely at work.

471. Are they all independent of each other, or do they communicate by pipes?—They all communicate by the main cylinder.

472. Not after the steam is formed, but are the boilers in the operation of raising the steam, does the water in each communicate so that the entire steam which is evolved should be of the same temperature?—It is difficult to say that; my recollection of the nature of the boilers is, that the flues pass backwards and forwards; but I would say that I do not know the details sufficiently to answer the question. They are connected mechanically. I recollect one vessel that exploded very near the spot where I was, and the end of the cylinder of the five boilers went off, and the five boilers were projected at an angle of forty-five right down into the bows of the boat.

473. So that if one of those boilers blow up, there will be four in action?—There was one blew up, and it carried the others with it.

474. Would four still remain if one were carried away?—On the contrary, this one carried the others, and blew them all to pieces.

475. That was only because the others were not sufficiently strong to resist the pressure; but had they been sufficiently strong to resist the pressure, would they have blown up?—I do not know.

476. Do you see any particular advantage in this plan of having five boilers?—I rather imagine that they get a larger surface; all our steam-boats have more than one; in the high-pressure boats they want to get a large surface of ardent heat; I cannot answer the details sufficiently.

477. Do you see any advantage in the arrangement of the boilers being upon deck, or is it for the convenience of passengers?—I think it is done to leave the whole free from cargo; it could not be done on any boat that goes to sea.

478. Do vessels that navigate from New York down to the sea, steer in the usual manner?—No, they have not all the apparatus; but their machinery being upon deck, and being raised up a great height, they have all fixed helms, so that the helmsman could not take them down; they are all forward, they are all steered on the bow, some on a platform, and some on the forecastle.

479. The hand gear that you have described as being in use on the Tay, I think you stated it was open?—It is on deck, as open as the wheel by which it is steered.

480. Is not that dangerous?—It is under the protection of the engineer; the engineer is supposed to be at it; any man might turn it in an emergency; it is no more in danger than the wheel; and I wished the management of the machinery to be as much under command as the steerage of the vessel.

481. This hand gear enables the person to back it, or to steer it?—Yes, without the exercise of any knowledge upon the subject, except to observe the marks.

482. This hand gear must always be at the same distance from the steersman?—I do not see why they should not be within reach, so that the captain might turn it.

483. The engines in our vessels are always placed near the centre of the vessel?—Yes.

484. How would it be possible so to place the hand gear that it would be within the reach of the steersman?—I conceive that there is no difficulty in communicating motion to the engine along a considerable length by means of a bar; but that is a difficulty

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difficulty that an engineer would answer better than I can; I do not conceive that there would be any. Captain Basil Hall.

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485. Will you state to the Committee what is your opinion of a regulation, providing two or three, not less than three, lights at the mast, in a perpendicular or an horizontal direction, to distinguish a vessel coming up or going down the river; for instance, if you have three perpendicular lights for coming up and three horizontal going down, do you not think it would be useful, inasmuch as it would tend materially to warn smaller craft to get out of the way, knowing whether they were below or above such a vessel, the one having the lights horizontal and the other perpendicular, and also to steam packets or vessels meeting each other, so that one might go in shore, and the other keep the centre, according to the tide. Would not such a plan be beneficial and avoid injury?—My own professional opinion at this moment is, that the usual plan of having one good light would answer all the purposes. If two vessels are meeting, and each of them has a light, they will infer that they are meeting; if they are not meeting, it is no matter; and I have observed frequently in steam-boats coming along the increasing size of the lights, and various ways by which you can tell that she is coming towards you and not going from you. I am not myself of opinion that any good would be gained by having anything more than a good light; we do not often find accident arising from that circumstance.

486. The rapidity with which these steam vessels come upon boats with one man sculling her to the shore, which is a very small power, being so great, one light does not show whether it is a light from a sailing boat or a light from a steam-boat. If a man saw a steam-boat, and knew she was coming up with the tide, he would feel more anxious to get out of the way at night than if he did not know of it?—My answer had reference exclusively to having a different light to steam vessels going up and down. I have no objection to have a light to distinguish steam-boats from other boats; but I think it would be much more difficult to instruct those people which it applied to, and the chances of accident from their miscalculating would be greater than leaving it doubtful; but I think there should be a distinguishing light between a steam vessel and a sailing boat.

487. Have you seen the revolving lights placed upon three lanterns, invented by Mr. Higgins?—No, I have not seen anything of that kind.

488. Will you look at that; what is your opinion of that?—[*The same was handed to the witness.*]—The more simplicity the better.

Captain John Fisher, called in; and Examined.

489. YOU are one of the harbour-masters?—Yes. Capt. John Fisher.

490. How long have you been so?—Between 11 and 12 years.

491. Is it any part of your duty to attend to steam vessels coming up and down?—So far, that when we see them going beyond a certain speed, we generally take notes of it, and direct them to go quietly through the Pool.

492. Do you go alongside of them in your boat?—We cannot get alongside of them.

493. Your business is to regulate the Pool with regard to vessels lying, more particularly?—Yes.

494. But you have lately checked the speed of steam vessels?—Yes, always.

495. Has that arisen from any accidents to ships in the Pool?—It was a regulation made by the Lord Mayor, that they were not to go beyond a certain speed in the river, from the east end of Greenwich to the West India Dock at Limehouse; they are to slack their speed going with the tide; they are allowed to run at about the rate of four knots; and from the West India Docks up to London Bridge, three knots with the tide, and four against it, which makes a difference, because when the wind is blowing strong, and the tide against them, they are obliged to put on more force, which will always cause a sea. I could furnish the Committee, if they wish it, with the Lord Mayor's printed regulation.

496. Will you state to the Committee whether you have seen any accidents arise from the rapidity of the steam-boats?—I have never seen any boats run over myself, but I have seen them swamped.

497. Will you state generally the accidents you have seen?—I have seen several.

498. Will you state any that you have seen?—I have seen some caused by the rapidity of the vessels.

499. Relate any that has come within your observation?—I have not any particular one to recollect; but it frequently occurs that boats are swamped lying in the shore from the sea coming in.

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500. Did you ever see one yourself?—I have seen 14 or 15 different cases within the last three years.

501. How long has this regulation you speak of obtained?—About five years.

502. During that five years have you seen any accidents?—I have seen boats swamped.

503. How can that be?—They know the harbour-masters' boats by a flag which they carry, and they generally take care, when they see them, to go along at a regular pace; but we cannot be every where, and they take advantage when we cannot see them.

504. They do not follow that rule generally?—No, certainly not; and there is no way of punishing them for it.

505. You are quite certain that you have seen 14 or 15 swamped?—Yes.

506. Within what space of time?—Within these three years.

507. How far does your jurisdiction extend?—From London Bridge to Bugsby Hole.

508. You are speaking now of that distance?—Yes.

509. And about the Pool?—Yes; most of the accidents have happened between Greenwich and London Bridge.

510. Do you conceive, that if the speed at which they were allowed to go were honestly regulated, it would prevent those accidents?—Certainly.

511. Are you of opinion that the steam-boats going up and down the river by night ought to be distinguished by lights, distinguishing which are coming up and which are going down?—Yes; some carrying two lights at the mast head, and some three, besides a light under the bows.

512. If some carry two and some three, there is no fixed regulation?—There is no regulation as to the number.

513. Do you think a regulation would be useful?—Yes.

514. Do you think it would be useful to distinguish those who are coming up and those who are going down?—They can always distinguish from the light under the bowsprit, because when they go down the light is in a contrary direction.

515. Will you describe to the Committee some one of the accidents which have occurred, which you have observed?—Two years ago there was a foreigner crossing the river, and one of the steam-boats went over her.

516. Where was that?—At a place they call Cuckold's Point; he was crossing the river, and the paddle-box caught the gunwale of his boat at the outer edge, and cut the boat in two; one man was very seriously hurt, and the captain of the vessel was very much injured. I think that was the last that I saw, but I have heard of several.

517. At what speed was the steam-boat going?—I was nearly half a mile astern of her at the time. I came up, and I saw the steam-boat go on board of her.

518. Did you make any inquiries about her?—Yes.

519. What did they say?—The waterman opposite said that she was racing, as they call it.

520. Do you ever see them racing?—No; when they see us they go at a quiet pace, and when they get past us they put on again, from what I understand.

521. Have you observed, when the steam-boats get up the Pool, that the boats crowd round them in great quantity?—Yes, certainly.

522. Does not that expose the boats that go off to great danger?—When they come off with passengers, a signal is made by the captain, by putting his hand up to stop the vessel.

523. Do not the boats go off when they have not passengers?—No, unless they are called; and I have seen them invariably stop their speed when there is any passenger to be taken on board.

[A letter from Captain K. B. Martin to the Committee, was read as follows:]

“To Colonel Sibthorp and the Gentlemen of the Committee on Steam Navigation.

“Gentlemen,

“I most respectfully submit a suggestion which I had intended to make, but which escaped me in my evidence of yesterday. The undulation of the waters in all the rivers of the United Kingdom are much increased by the violent competition of contending parties; as, for instance, in the Pool: A Margate and Gravesend boat starts at nine A. M. from the wharf near London Bridge; by the time they are abreast St. Catherine's, a Margate and Gravesend boat are sheering out from that place of embarkation also, and thus four powerful vessels are passing down

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down the Pool at the same instant. Now, admitting they restrain their speed within the limits specified, still the inconvenience to craft of all kinds is increased in exact proportion to the number of vessels so closely following each other, and vessels bound to the same place thus afford a strong temptation to additional exertion on the part of those in charge of them. This evil does not cease with the Pool; there are deep-loaded craft in many of the reaches of the river, and two steam vessels racing for the mastery necessarily create a greater swell by the meeting of their waters thrown off by the wheels. This would be much relieved if vessels bound to the same port were not allowed to start at the same instant of time. If one started at nine, the other at half-past would be clear of her. The collision, the alarms of the timid, would cease. The passenger too late for one might avail himself of the other, and it would be a public accommodation. I merely throw out these hints for your consideration; and believing it my duty, as the commander of a steam packet, to give you every information in my power, I have obtained permission to attend this day in order to my being called, if necessary. I have the honour to subscribe myself, Gentlemen, your most obedient servant,

Capt. John Fisher.

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524. Do you concur in that suggestion of Captain Martin?—I think that it would be reasonable, if it could be adopted.

525. Have you noticed those four vessels from London Bridge going together?—They go at the same time; two go to Gravesend and two to Margate, from London Bridge and St. Catherine's. There are four start at the same time, but the two from St. Catherine's Dock are generally a-head of the two others.

526. Have you seen four vessels go through the Pool at once?—Yes, five or six.

527. Is very considerable inconvenience occasioned by the undulation of the water?—Yes.

528. You spoke just now of certain regulations; will you be so good as to state what the regulations are?—I believe I mentioned that we are allowed to go five miles against the tide, and four the other way; and then, when they get off to the East India Dock, they are allowed to go three; I think that is the regulation, or very near that.

529. Supposing they are coming up with the tide, they are then allowed to go four knots an hour?—Yes.

530. What are they allowed to go when the tide is against them?—Four, I think it is; above the West India Docks, five; and I think it is four afterwards.

531. What speed does your tide run in the spring tide, within about two hours of the ebb, with a flush of the wind?—Between three and four knots.

532. If steam packets are only allowed to go four knots, how do they get up?—They go a little faster than that, certainly.

533. If you allow them to go four knots an hour, the tide may run against them?—They must stem the tide.

534. At what speed do you think they ought to run to stem the tide, so as to be able to satisfy the passengers on board?—I believe the passengers that go on a steam-boat are never satisfied unless they go as fast as they can.

535. What do you think they might safely go at, if the tide were running four knots?—I think they ought to run two knots over the ground from what we call the Lower Pool to the place where they land.

536. Then they would be allowed to go six knots?—Yes.

537. Then do you not get into the inconvenience, that a vessel going above four knots will make that disturbance which does so much mischief to small craft?—I have seen them go at the rate of five knots, and there has always been a considerable sea.

538. Then in point of fact, according to your judgment, when they are coming against the tide, you must regulate them by saying, that they must be allowed to go six knots, or two knots above the tide?—Yes; there is a great difference between the tide. I have seen the tide run six knots sometimes.

539. Have you ever the seen tide run more than five knots?—Yes; I think in the narrow parts of the river, after heavy rains, in the winter time, I have hardly been able to stem the boat.

540. How fast could your boat pull?—Between seven and eight knots an hour. I have pulled up from Greenwich in three quarters of an hour against the tide in my boat, and that is five miles.

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541. Are the Committee to understand you to say, that you could not allow fairly, as a maximum speed, less than six knots?—No.

542. In going down how fast does the tide flow up?—Not so strong; it takes an hour and a half before the water below the bridge is on a level with the water above.

543. How fast have you known the tide in a spring tide flow upwards?—I think nearly four knots.

544. Then you could not give less than six knots as a maximum speed for vessels to go down at?—I should think not against the tide.

545. What should you give them with the tide?—I should say about three knots with the tide; that is, from the Pool to the West India Docks.

546. Then you would give them three knots of tide?—Yes.

547. And your maximum there would be seven?—Yes.

548. By which you mean to say, seven over the ground, and three by the log?—Yes.

549. Then your maximum would be about the same?—Yes; I should think there would be very little sea knocked up by the paddle-wheel.

550. Does not the strength of the tide depend upon the force and direction of the wind very often?—Certainly.

551. Under all the circumstances which you have stated, if a fixed rate of velocity were enforced, could that regulation be always carried into effect, or must it not be often departed from?—Certainly, in a trifling degree.

552. What difference does a strong wind, up or down the river, make upon the velocity of the tide?—It depends upon the strength of the wind; with a strong easterly wind makes a very great difference; sometimes I have seen vessels that have not been able to go down the river; there has not been sufficient tide to drive her down.

553. Then, under such circumstances, a steam vessel must put on as much power as they have?—Not so much as they may have.

554. They must increase their power very much?—Yes.

555. Would a vessel, going six knots through the water, make head way against the tide, increased in velocity as it would be by the strength of the wind?—I think going six knots in the Pool by steamers will always carry them through the Pool; I do not say below, where there is an open sea way; but in general there is something in the Pool to shelter the vessel from the wind.

556. Then you think that six knots would be sufficient in the Pool?—Yes.

557. And you do not think it would be necessary to deviate from that?—I should think not; it must always depend upon circumstances of wind and tide.

558. Supposing that Parliament were to make a regulation as to the speed of a vessel, that regulation would naturally impose a penalty, and that penalty, before it could be enforced, would require an oath; does it occur to you by what means, if an accident happened, and the vessel was going six knots and a half, or even seven instead of six, that penalty could be enforced by an ordinary person?—I should think not an ordinary person; it must be persons that have been accustomed to the sea; but you could not within half a mile. I think I might guess above that; I should say a vessel was going above that rate.

559. Supposing you were not there, and the persons who had seen them were rowing about in boats and barges, do you, as a seaman, believe that they would have the power of fairly stating between man and man what was the rate of the vessel's passing, whether it was above six knots or below?—I should think there would be a great difficulty.

560. Can you point out any mode by which this could be ascertained?—The only mode I think that could be made out would be for a person to take out his watch to see when a steam vessel passes a certain point, and then to see when another passes that point.

561. You are aware that when the accident happened, the vessel would stop; the person who swears to the penalty must swear to the speed which she was at that time going; do you believe it possible that any man in the ordinary line of life could guess the rate at which a steam vessel was passing, within a mile?—A seaman that was accustomed to it could do it, but not any other person.

562. Supposing a man were put on board the steam-boat on purpose, could he, being on board, ascertain the rate at which the vessel was going?—I consider that a person that had been to sea, if he was on board the steam vessel, could swear that he was going above a certain rate, but I could not swear to half a mile.

563. You are now speaking of Bugsby Hole; would it not, in nineteen cases out of twenty, be under the inspection of nautical men?—I do not know how to answer that.

564. Do

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564. Do not you believe, taking the best ship's company that ever lay in the Pool, that if the whole of the men were looking at the vessel as she was going on, and seven of the men were to say at what rate they considered she was going, the rates they gave would be quite different?—That is a thing which I cannot answer.

565. Your answer is, that if they were going above six knots, they could ascertain it?—Yes, no doubt of it.

566. The inconvenience that you find is from going at great speed in the Pool; do you find that vessels coming up singly are inclined to go at a speed which is dangerous to persons on the river?—No; the speed is generally kept up by the opposition boats; but when they come up singly they come up, I think, quiet.

567. Practically, then, the inconvenience is found only from racing, and not from the average speed?—Yes.

568. Would not a better mode be to check the racing?—Yes.

569. And to make a regulation of this kind, that vessels coming up the Pool should not approach within a certain distance of each other?—I do not think you could exactly prevent their keeping a certain distance of each other.

570. Would it not be as easy to prevent their coming within a certain distance of each other, as to prevent their going at a certain speed?—I should think not, without you place people on board to regulate that.

571. You have spoken of regulations; in point of fact, from one reason and another, are not those regulations almost nugatory?—I recollect, about four years ago, in Alderman Brown's mayoralty, I think, I went to make a complaint of steam vessels going too quickly through the water; and the alderman said, "We will punish steamers;" and the captains said, "By what law will you punish us; there is no law to punish us."

572. In point of fact, are the regulations kept?—I mentioned before, that when they see the harbour-master's boat, or the police boats, they slack their speed.

573. Generally are those regulations at all kept?—As far as practicable.

574. Do the steam-boats generally, that pass through the river, go at the rate you have described, of six knots an hour, or do they go faster than that?—Much faster.

575. Generally?—Generally; they do not come under my view, or under the view of the other harbour-masters, because we caution them when we see them going faster.

576. You have stated that during three years you have witnessed 13 or 14 accidents?—Yes.

577. You have described an accident which happened to a foreigner?—Yes.

578. How long was that ago?—Two years ago.

579. Was that the last accident you have seen?—Yes.

580. Do you mean to say that you have seen no accident occasioned by a steam vessel within the last two years?—No; I have seen boats with a ton of water thrown into them.

581. Within the last two years have you seen any wherries capsized by a steam-boat?—No, not one.

582. You have spoken of a ton of water being thrown into a boat; what description of boat was it?—They were boats that carried goods to the ships.

583. Would not that circumstance injure the goods?—I have understood from the masters of the vessels, that in consequence of the water being thrown into the boats, they have found the goods much damaged.

584. Have you seen any of the Essex barges?—No.

585. Are not those lug boats very heavily laden?—Yes.

586. So that the boat is brought very near the water?—Yes. Since steam navigation has been adopted, I think boats do load too deep, and it will require a different kind of boats to navigate the river, such as there are at Portsmouth and Plymouth.

587. Will not that be a loss to the owners of that craft, not to be able to load so deep?—Yes, it will be a great loss.

588. Instead of carrying 100, they must carry 80 or 90?—Yes.

589. Will not that be a loss to them?—Certainly.

590. Would it not be easy to adopt some kind of wash-board?—I have seen the water coming into the deck, and the wash-boards round the combings prevented her from filling.

591. Your duty, as harbour-master, is to prevent any mischief of this kind arising from steam vessels?—Yes, and to look after the moorings.

592. This duty has been imposed upon you to prevent steam-boats going above a certain rate?—The harbour-masters presented to the Lord Mayor a complaint

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upon the subject; and he asked us to take care that steam vessels did not go above a certain rate.

593. If this were an essential part of your duty, would it not be bad policy to carry a flag?—There is a bye-law by which we are obliged to carry a flag.

594. Can you give the Committee any other detail of accidents which have happened from steam-boats?—No, none but what I have stated; that is the only one I have ever witnessed.

595. You have seen thousands of steam-boats passing up and down the river?—Yes, and boats passing them. But I would beg to state to the Committee that a great part of the accidents that do happen, arise from the lightermen and boatmen and bargemen themselves; for I have seen at times, when, by pulling a stroke of their oar, they might get clear of the steam-boats, they lie upon their oars, and will not get out of the way. I have seen water thrown into the boats, but I have never seen any accident.

596. You stated that within three years you had seen 13 or 14 accidents?—I have only heard of them.

597. How long have you been harbour-master?—Between 11 and 12 years.

598. How long of that time has steam navigation been in use?—Two years before that time it was in use in the Thames; but I had seen a single vessel running up and down before that.

599. In what year did they begin?—In 1814 or 1815.

600. Do you think that accidents have increased or decreased of late years?—Since the steam boats have been increasing, the accidents have been increasing.

601. Have they increased, in your judgment, in the ratio of the increase of the steam-boats?—No, not in the ratio now mentioned.

602. You do not think they have increased in the ratio of their number?—No, certainly not.

603. Do you think, as the persons employed in steam navigation have become better acquainted with that art, that accidents have increased?—I do not certainly think that they have increased, because from what observations I have made with steam vessels which I have observed, they are more careful.

604. Are not there more steam-boats running this year than last?—Yes, certainly.

605. Have there been so many accidents happening this year as last?—I have not heard of any.

606. Do you mean to say that there have been no accidents this year?—Certainly I have heard of boats cut to pieces.

607. Seeing there are more vessels running this year than there were last, has there been an increase of accident, or the contrary?—I have not heard of it.

608. Have you not heard of several people being drowned?—I have heard of one or two, I think.

609. Were those from the neglect of the captain of the steam-boat?—One was at the last fair; there was a man drunk, and he would not pull out of the way.

610. Is there a larger proportion this year of accidents than the last?—No, I do not think there is, from what has come under my observation; they never tell me when a person is drowned or injured.

611. Has the increase of the knowledge of steam navigation decreased the number of accidents, or not?—I cannot state that.

612. Have you not seen a great many accidents, perhaps of a much less serious description than those you have now mentioned, so as to support your observation that you had seen 13 or 14 accidents?—I have not seen any accident since the accident of the foreigner; but I have heard the watermen mention that they have had their boats swamped.

613. You are afloat on the water very much?—Yes.

614. There are four harbour-masters, are there not?—Yes.

615. How many harbour-masters will there be out in the day?—On the flood tide there will be all of us.

616. Have you heard any of the harbour-masters talk of any accidents?—Yes.

617. How many sailing vessels have you seen, before steam packets were in use, start at the same time to go down the river; Gravesend boats, and all sorts?—It would puzzle me as to the number; sometimes there are large fleets, and at others there are very few.

618. How many have you seen start at one time; have you seen half a dozen?—I have seen from 40 to 50.

619. How many do you see, now the steam navigation is in use; do you see so many

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many as formerly?—Certainly not; they are wonderfully reduced; the coasting trade is wonderfully reduced, because there is a great deal carried on by steam.

620. Before steam navigation was in use, and when so many sailing vessels started together, did many accidents happen if they started with a contrary wind and were obliged to work down the river?—No, I have not heard of that.

621. How many steam vessels are there coming into the Pool daily, and how many leave it?—We have the number at our office, and I could tell from that.

622. Can you answer it now, within a few; how many pass your office daily?—I should think, upon an average, I may say a dozen going.

623. Going and returning?—A couple of dozen. There are a great many foreign vessels that do not return; they do not go regularly.

624. You stated that the boatmen and the bargemen do not sometimes get out of the way of the steam-boats; if a bargeman was going down the river and one of these vessels was coming up, at the rate of 10 knots an hour, would it be possible for him to get out of the way?—I think when they see the steamer a great way off they might, by a stroke of their oar, leave a clear way.

625. Might not a steamer get out of the way much better than a barge?—It depends upon the number that there are. I have seen the steam-boats come upon them.

626. Do you mean, if the steam-boat was coming with that speed, that they could get out of her way?—When they see the steamer at a considerable distance they might go to the northward or southward; but they lie in the middle without making any effort.

627. Supposing there are a number of coal barges in the way?—I do not mean to say that they can always get away.

628. Since the making of the great number of docks in the river, has not the number of vessels that moor in the river very much decreased?—I cannot say that they have; the docks principally take in vessels from foreign ports; the coasting trade lies in the river; there is generally a small decrease in the number of vessels, but not to any great extent.

629. Do you mean to say that you consider that all the foreign trade goes into the docks, and does not lie in the river?—A great part of it; I believe the greater part of it; the Baltic; but a great many of them go into docks.

630. And almost all the sea-borne go into docks?—The greatest part of them.

631. Does that not decrease the number of ships lying in tiers generally?—It did formerly; but I have not found much decrease since I have been in the service.

632. Do you think that it would be possible, with the number of vessels that you have upon an average, to appropriate a space in which the steam-boats should run up and down, and nothing should be moored or placed in that space?—Not without incommoding the trade very much.

633. What is the full extent of the Pool?—About two miles and a half from London Bridge to where the colliers lie.

634. How far do the Lord Mayor's regulations extend with respect to the speed of steam vessels?—From the east end of Greenwich to London Bridge.

635. What distance is that?—About five miles.

Captain Robert Welbank called in; and Examined.

636. WHAT are you?—An elder brother of the Trinity House.

637. Are you, in your official capacity, very much in the habit of going upon the river?—Occasionally; we do not go very much; we do not frequent the river so generally as to enable me to give any particular information; it is only common information I can give with respect to the steam navigation of the river.

638. Will you have the goodness to state, as far as experience will enable you, what effect the steam vessels have upon the river; whether they are inconvenient to small craft upon the river, and whether you could reduce that in any way?—That is precisely the general point upon which I wish to answer. Certainly every man going upon the river must have observed the undulation occasioned by the passage of the steam vessels, that is very alarming to small boats and barges. Now we at the Trinity House have the power of granting licences to old seamen; men who, having passed the prime of their life at sea, desire to gain a small pittance for their livelihood upon the river. I have seen their wherries tossed about upon the shore by this undulation like cockle shells, or anything else you please to describe, to their very great inconvenience. With respect to any accidents that may have arisen to our barges at the Trinity, I have brought the superintendent of our barges to give

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any evidence upon that subject, and I have also brought the captain of our yacht, who is as well acquainted with the river as any man, and from those two men the Committee may obtain any information they wish as to the navigation of the river from Blackwall downwards, and the navigation of the river from Blackwall upwards. With respect to regulations, it strikes me that the Committee cannot regulate speed to any good purpose; but I think that they might distinguish the two classes of steam vessels, the one, those employed in trade, from the others, those employed in pleasure. The vessels employed in trade are not confined to time, and may therefore take all the same precautions that vessels under sail do, and drop up to their berths without any inconvenience to the public, either to the wharfs or to the tiers.

639. When you say drop up, what do you mean?—By dropping up from Blackwall without causing that ebullition which steam vessels always do, that they may take their time; but vessels of pleasure, to whom it is an object to arrive at a moment for the pleasure of their passengers, those vessels I think should be confined to a particular part of the river; I think that they should not proceed beyond a certain point, that they should not proceed further than Greenwich or Limehouse.

640. Have you had before you at your Board any complaints or any discussions regarding the annoyance occasioned to your barges by the steam vessels?—I desired our superintendent yesterday to come prepared to answer that question, and I believe he has come prepared to answer that question. I was one of the party who originally established Scotch steamers, and I was perhaps the only nautical man in the direction of it. I strongly enjoined all the masters of those vessels to give way upon all occasions to all vessels under sail; and I told them that if any complaint came to me of misconduct in running aboard any vessel, I should always take the side of the boats and sailing vessels. A steam vessel may always proceed to any point she pleases, she may either draw up or retrograde or turn, as the captain thinks proper, and therefore he is without excuse.

Mr. William Honeyman, called in; and Examined.

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641. ARE you superintendent of the barges belonging to the Trinity House?—I am.

642. Will you be good enough to state to the Committee any inconveniences or damages that have been caused by steam vessels to your barges?—We are frequently annoyed by the steam vessels passing up and down the river, from the undulation of the water, and oftentimes by their running on board the lighters. When at work, and also when removing goods, and while under weigh, damage frequently occurs to the Corporation's craft, which I superintend.

643. Will you name any particular ones which have occurred within the last year?—Only hearing of this the last evening, I have not had sufficient time to recollect all, but I can mention some, though not all. The last occurred on the 2d of August, the lower part of Greenwich, by the Essex steam-boat running on board the Trinity barge, No. 12; the barge was driving down to her work; the steam vessel, running down, (I did not see it—the men report to me immediately), ran on board the barge, though I understood there was sufficient room to keep clear of her; they drove her against another steam vessel, and did her considerable damage.

644. What did that arise from; if the steamer had been going slower, would that have been avoided?—If it had been going slower it would not have done so much damage; but he might have kept clear altogether.

645. It was the carelessness of the helmsman?—Yes, or oversight.

646. Will you go on to detail the next accident?—The next is the 27th of June last, near the Horseferry, Rotherhithe. The steam packet, Royal Adelaide, struck the Corporation's lighter, No. 20, and thereby damaged her. It appears from the information, (I saw the steam packet directly afterwards, but did not see the blow struck,) that she was what we call put by, and could not keep her force, and was forced to throw herself astern, by throwing the engine the adverse way. The next was on the 15th of March, the Harlequin steam packet, belonging to the General Steam Navigation Company, nearly abreast of the Surrey Canal, at Rotherhithe, ran on board the Corporation barge, No. 9, when loaded, and the steam vessel having a ship astern at the time, threw the barge nearly athwart her bow, which caused considerable damage.

647. How did it happen?—The steam vessel was towing an American ship down with the flood, the barge was driving up; the steam vessel took the larboard bow of

of the barge, and thereby turned her under the bows of the American ship, which the Harlequin was towing under the tide.

648. Did not that accident, like the other, arise from the carelessness of the person who managed her?—Yes.

649. If that steam-boat had been a sailing-boat, and her master had been equally careless, that accident would equally have happened?—Yes, it might. The captain said that the wind blew very strong at the time; the American ship had her sails set at the time, as well as the steamer. The next was on August the 18th, 1830; the steam vessel called the Batavia (that steam vessel goes to Rotterdam,) abreast Greenwich ran on board the Corporation barge, No. 2. I applied to the captain of the steam vessel particularly, and asked him, being an open space, whether he could not keep clear of the barge, which was so heavily laden, and could not possibly get out of the way; he told me that barges should keep out of their way. I then said, that it was impossible, a vessel going down at the rate that his vessel was going at that time, that any barge of 60 ton weight, and two men in her, could possibly pull out of the way of a vessel going with that velocity; and the consequence was, that they paid the damage.

650. How many accidents have you down in your paper?—Only 13 on the paper.

651. Are they all of the same description; where there was room to have gone on either side, and where there was carelessness of the party?—No, I cannot say that the whole is. I cannot say that in the Pool there is as much room as at Bugsby Hole.

652. Will you take one of a different character?—On the 30th of June 1827, the steam packet George the Fourth ran on board the Corporation lighter, No. 35, while lying near the King and Queen at Rotherhithe.

653. At anchor?—Alongside a ship at that time.

654. Lying quiet?—Lying quiet. The consequence was, that considerable damage was done to the craft.

655. Will you go on, and state how that happened?—It was in the night; the vessel had a Trinity-house pilot on board, and he urged that something struck him out of his course, but the vessel paid the damage.

656. How many do you suppose in the sum total you could state?—I could not take upon myself to say the number from the two stations. We have two stations; my station is from the church at Rotherhithe to Gravesend; the other is from Prince's Stairs up the river; the other station is not conducted by me.

657. Which is conducted by you?—From Prince's Stairs to Gravesend.

658. How many accidents would the whole amount to in the sum total?—The whole station not being mine I cannot say.

659. Within your own station?—I cannot recollect any more in the given time, or only one or two.

660. During that time in which those accidents are included, have you had any accidents happen to Trinity-house craft by sailing vessels?—We have had several, but I have not got them down.

661. Do you think it would equal the number occasioned by steam vessels?—I think it would exceed them.

662. Will you be so good as to furnish the Committee with an account of all the accidents occasioned by steam packets within the same time?—I will. We have had much damage done both by us and to us, and I have to settle the whole, and mark the occurrences down.

663. You are speaking now of boats and barges not under your immediate care at the time; what do you know of your own knowledge and observation with respect to steam-boats?—I consider them very useful for passengers; but I think that they go at a greater rate of speed than they ought to go.

664. What rate do you observe them going?—Sometimes I observe them going at full speed.

665. What would be the full speed of a steam vessel?—Various speeds, from eight to ten knots.

666. Have you seen them racing one against the other?—I have oftentimes, but cannot mention the dates.

667. Have you seen the Adelaide and Harlequin racing?—The Adelaide has done us much damage.

668. Have you seen them racing?—I cannot positively say that I have.

669. But in your opinion they go much faster in the Pool than they ought to do?—After they pass Deptford, I think they go much faster than they ought to do.

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670. Are you constantly on the river?—No; sometimes in the office, and sometimes on the river.

671. Will you state, in the average every day, how long you are upon the river?—I am sometimes the whole day on the river, and sometimes not at all.

672. Generally speaking, how long are you upon the water?—Three days a week. What makes me say three days is, that I have to attend Trinity House on Monday, Wednesday and Friday, and then I go in the boat from Rotherhithe; but I do not go much upon the river on those days.

673. You see a great deal of the river?—Yes.

674. Independently of what you have stated as happening, have you experienced any inconvenience in going up and down the river, either to yourself or to other vessels?—I have experienced inconvenience, though I cannot mention the date.

675. Can you mention any others?—Yes, I have often returned with wet clothes, arising from the steam-boats; and from the George the Fourth I experienced great inconvenience near Cuckold's Point; I was then in a passage boat.

676. That was a wherry?—A large wherry, with wash streaks round her at the time.

677. Were the other passengers wetted at the same time?—They were; but the boat was large; I did not see any danger.

678. How far was the steam-boat?—Not more than 30 yards from us.

679. Was it so much as that?—It was not more; it is an open part of the river; we are out of the Pool.

680. Have you known accidents happen to other persons?—I have known them only by hearing of them; I never saw a life lost; I never saw a boat upset.

681. Have you ever seen one swamped?—I have heard of boats being swamped; I was once in the river when I found that a steam vessel had sunk a boat, and one person drowned.

682. When was that?—Four months ago, I think; not taking dates, I do not speak positively. I can mention another accident, though I was not an eye witness to it; that was on the 15th of July 1830. A young man whom I brought up, his father was drowned on that occasion, was in the boat at the time.

683. Do you know of this?—I do; I attended the jury. The young man was a nephew of mine; he was coming in the evening of the 15th July 1830, with passengers in the boat; the Hero steam packet was running down; this was in Limehouse Reach; the undulation of the water caused the boat to sink, and two persons were drowned.

684. It was not struck by anything but the undulation of the water?—No, not anything but the undulation of the water; and the evidence that was given on the jury was, that she was going 10 knots an hour. I did not see her.

685. Would the inconvenience be very much prevented, if the steam-boats were allowed to go only six knots an hour?—I think the inconvenience might be greatly reduced, by their speed being reduced after they have passed Greenwich; and if it were possible, where two contending parties are together, to keep them at the same distance as they are at Blackwall and Greenwich, or at Woolwich.

686. To what speed should they be limited?—It is hard to speak to that.

687. What is the distance that you would set between the steam-boats?—Perhaps they may be half a mile from each other; it would be certainly well if they could keep that distance: where two vessels are abreast, they take up a deal of room, and are liable to accident.

688. What speed should they not exceed?—I would more readily state it provided it was still water; but the run of the tide in the river Thames varies greatly.

689. Have you known any injury done to craft lying at her moorings, from the undulation of the water occasioned by steam-boats?—I do not remember any circumstance of that kind.

690. Have you heard of any?—I have; but I do not know of it.

691. You have seen sailing vessels try their speed against each other; have you ever seen accidents happen in consequence of that?—I do not bear in my mind any accidents, but I have no doubt there have been.

692. Do you think the number of accidents has increased or decreased of late years?—I think it has increased.

693. Do you think it has increased in a greater ratio than the increased number of steam-boats?—I cannot say that; there are a great number, but I cannot say whether it has increased in a greater ratio.

Captain *Jonathan Poulter*, called in; and Examined.

694. ARE you the captain of the *Trinity* yacht?—I am.
 695. Are you constantly moving upon the river?—Constantly.
 696. Principally from Blackwall downwards?—Yes.
 697. Do you often go from Blackwall upwards?—Sometimes.
 698. You lie at Blackwall?—Yes, at the Orchard-house, Blackwall.
 699. Have you observed steam-boats going up and down the river?—I have seen them every day.
 700. Did you ever observe any accident happen by them?—No.
 701. Have they given any inconvenience to you in your vessel?—Nothing to speak of.
 702. Has there been any inconvenience to you from the undulation?—Merely in passing; merely shipping a spray or sea.
 703. When you have been going up from Blackwall towards London have you ever seen any inconvenience from the steam-boats passing you at the speed at which they go?—I have seen steamers going up at high water when boats are coming out, so that it is impossible that they can go at one rate astern of another; she is obliged to stop still a certain time, and then to go at full speed to get through between the two vessels.
 704. Have you experienced any inconvenience from steam vessels?—None at all.
 705. Would that rate of going you have described be very inconvenient to all the craft on the river?—Very inconvenient.
 706. A sailing vessel could not increase her speed to eight or ten knots an hour?—Not in the circumstances I am describing.

John Mitchell, called in; and Examined.

707. YOU are a waterman?—Yes.
 708. Have you had any accident happen to your boat?—I was witness to a very bad accident in Isleworth Reach.
 709. When was that?—That was on Monday the 11th of July last. I was rowing up with a gentleman, and just as I was off Sion House, the two steam boats, the *Endeavour* and the *Diamond*, were coming by Isleworth, paddle box and paddle box; and I said to the gentleman that I had got in the boat that it was a very great shame that the two boats should come down paddle box and paddle box. A waterman rowed eight people from Isleworth; there were seven quakeresses and one quaker in the boat, and he rowed off to the Surrey shore from Isleworth to put them on board the *Endeavour*, but the two boats being so close together, the man at the wheel of the *Diamond* up with the helm, and bored upon the bow of the *Endeavour*, so that he pressed upon the man who had the eight people in the boat. This is the same as I told the coroner. I was then opposite to them, at least I was on the Middlesex shore, as this accident took place on the Surrey shore, and directly as the boats passed me: the man was on the Surrey side of the boats, I was on the Middlesex side; the boats passed me, and I heard the waterman cry out, "For God's sake come here;" and I said to the man that I had in the boat, "There is some accident;" and I had not said the word before I saw the boat bottom upwards. The *Diamond's* paddles had not stopped before she struck the boat, and I am sure the *Endeavour's* paddles had scarcely backed. I then rowed towards the boat, and just beyond the boat I saw a woman paddling as hard as she could strive in the water, and I rowed to her; I almost overshot her; but the water being clear I could just see her scarf, and very luckily it happened to be fast round her neck by a clasp, and I had almost overbalanced, but I caught hold of the gunwale of the boat, and by that means I kept my grasp.
 710. Did you save her life?—I hauled her in after a bit; she had fast hold of my shirt, so that I could not get her to let go; and the surf of the two steamers being under the stern, I took a great quantity into my boat, and I was obliged to get the gentleman to sit on the other side, or the surf would have sunk the boat; I then rowed to the boat that was bottom upwards, and I turned her over, and they cried out from the steamer that there was another, and underneath was a cushion and a pair of scales; and Miss Fanny Nash, whom the jury sat upon, was drowned.
 711. Was any other drowned?—No; they hooked the people from the steamer, and they hooked them, because they had their clothes torn off them.
 712. How fast was the steam vessel going at that time?—At her full speed.
 713. How fast is that?—Between 10 and 11 miles an hour; they were going

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with the tide ; and then I asked the young lady what I should do with her, and she said, as her friends were on board the Endeavour, I had better put her on board too, and she did go on board.

714. Have you known of any other accidents?—No, not to my seeing.

715. Have you ever, in your boat, experienced inconvenience from the undulation of the water occasioned by the steam-boat?—Yes ; I was rowing with one person one day, and I was obliged to go in between the tiers, so as to get the sea broke from me, the steam packet made such a great swell.

716. Do you ply above the bridge generally?—Yes.

717. Is your boat lighter than those below the bridge?—No ; it is licensed to carry eight, and she will carry eight.

718. Do you think the undulation would have sunk your wherry if you had gone near her?—Yes ; and when I was going to Isleworth there was only room to pass ; the undulation must have run up the bank when there were two steam-boats, when they were paddle box to paddle box.

719. Has it often happened to you to be obliged to get out of their way by that means?—I never get out of their way above bridge ; the boat will dip from the undulation, but I am not afraid of them.

720. Have you often had fares this year below bridge?—Frequently.

721. How often have you been obliged to go out of your course?—Almost always when I have gone down.

722. How often does that happen?—About twice in a week, when I have been going down.

723. In the middle of the day are you subject to those inconveniences?—The steam-boats are running at all times.

724. Not so many as in the morning and evening?—I cannot exactly say, but I have frequently met one.

725. Do all the watermen below bridge make it a rule to go out of their course?—They must have a lug-boat if they do not think fit to carry passengers ; I have seen a lug-boat pitch her head at it, and almost bows under, when she has been in the troughs of the sea.

726. You have been accustomed to steam vessels ; do you know whether, when they reduce their speed, it reduces that inconvenience?—I have never seen them check their speed. I left my boat at King's Arms Stairs, Millwall, not a month ago ; and I only went to get change for five minutes, and when I came back there was my boat sunk, and all the gear floating about.

727. Whereabouts is that?—Millwall, Poplar.

728. When you came back and found your boat was sunk, and all the gear floating about, what was the cause of it?—One steam-boat.

729. How near did that go to the shore?—Not quite half water off ; about a quarter of the river at Millwall ; I think they keep close in there, on account of the water ; but I will not be sure of that.

730. Above bridge they do not go so fast as you have described generally?—They go at their full speed ; I have never seen them stop, except to take in a passenger.

731. At six miles an hour on the river would the packets inconvenience the boats?—No, it would not inconvenience boats at all.

732. Did you not say that you had not seen vessels go at the rate of six knots?—Yes.

733. How then do you know that the vessel going at six knots would be no inconvenience?—Because she does not make so much surf ; when she stops her way there is not so much surf.

734. What stairs was that where you had left your boat?—King's Stairs.

735. There are several stairs there, are there not, where watermen are in the habit of laying their boats?—Yes ; when they leave their boats they hang them off their anchors, but my boat was a-head upon the shore, so that as the surf came it went over the stern.

736. The accident which happened to you occurred from your not taking the same precaution as other watermen do?—Yes ; but I only went for five minutes.

737. If you had been looking at the boat it would have been the same thing?—No, I had no chance of mooring her, because the surf came and carried her away.

738. Is there anything else upon which you can inform the Committee?—Nothing further.

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Thomas White, called in ; and Examined.*Thomas White.*16 September,
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739. YOU are a waterman on the river?—Yes.

740. Where is your stairs?—At Bankside.

741. Have you ever experienced any inconvenience or mischief from the steam-boats?—Yes, from the Erin steam-boat in July.

742. Will you state to the Committee what happened then?—I was taking six men to row them down to Limehouse, six stone-masons ; they had their tools. I shot through London Bridge with four men besides myself, with their tools, and I took in a man and boy at the Custom-house, and proceeded down the river ; and as I was rowing down, just below the Tunnel, the Erin steam boat was coming up, and as it came up swamped me.

743. How near were you to the packet?—About the distance that I am from the Abbey (*about 40 yards*).

744. How were you swamped?—By the undulation of the water.

745. Were you upset?—Yes, I was upset, and one man drowned, and we were all seven in the water together, and the boat sunk and went away from us all.

746. Was there any other steam-boat that had passed you?—No, there was only one ; we met at London Bridge.

747. Have you seen any other accident happen occasioned by steam-boats?—No.

748. Did the accident occur in consequence of the sea that was made by the steam-boat, or in consequence of the people that were with you jumping up at the time?—By the sea entirely.

749. At what speed do you suppose, in your judgment, the Erin was going at that time?—I should reckon she was going near eight miles an hour.

750. What was your boat licensed to carry?—Eight.

751. And you had only six in?—Six besides myself.

752. Are you allowed to carry eight besides yourself?—Yes.

753. You had also tools with you?—Yes.

754. How much free board had you ; how many inches were you above the water?—Above a foot and better.

755. You had seven men and all their tools in?—Yes.

756. The steam-boat had passed you?—Yes.

757. Were you attempting to row across the current of the tide?—Going straight down.

758. You had not altered your course for the steam-boat?—No.

759. Did she pass you the same way that you were going?—No.

760. Have you seen any other boats swamped?—Yes, I have seen them below the bridge.

761. How many?—I cannot say how many.

762. Four or five?—Yes, more or less.

763. By the swell occasioned by steam-boats?—Yes.

764. What is your stern out of water, in the ordinary course of things, with no passengers in?—Above a foot and a half.

765. When you have passengers in your boat, within what number of inches is your gunwale of the water where the company sits?—I should think, about six inches.

766. Then the weight would be more astern of the vessel ; your passengers would be nearer the stern than they would to the bow?—I should think not.

767. Had you the men spread about in the ship?—Yes ; the man that was drowned was sitting abaft.

768. Were the whole of them sitting in the back?—One of them was sitting aft, the man that was drowned ; the others were sitting in the midships of the vessel.

769. Then that part of the boat was deeper in the water than the bow?—Yes ; I had the tools as well.

770. The tools were not equal to the weight of seven persons?—No.

Benjamin Green, called in ; and Examined.

771. YOU are a waterman?—Yes.

772. Where are your stairs?—I used to look out at Bell Wharf Stairs.

773. Will you relate to the Committee any accidents that have happened to yourself, in the first instance, on the river, arising from steam vessels?—As I was going out from Bell Wharf Stairs, outside Bell Wharf, the Yorkshireman steam-boat was coming down at a great rate : we had two dips, and it sunk all of us, together with six men in and myself, seven, and the meter, which was John

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Newton, and the man was pulled up, and four men; they were saved, and I was washed under the ship's bottom, and they thought I was dead, and I have been at home ill ever since, and I have now a bad leg, which I got then.

774. When was this?—It was last year, I think, somewhere next month.

775. Did the boat sink, or upset?—The boat sunk under us, and filled with water, and I was taken up for dead.

776. Had you anything in the boat besides the six men?—Nothing at all.

777. How many is your boat licensed to carry?—Six; it had plenty of free board to take them off.

778. How near were you to the steamer when this happened?—I suppose she had been gone by a minute or two; I reckon she was going 12 or 13 miles an hour.

779. Do you know of any other accident which has happened, occasioned by a steam-boat?—I was coming up with a barge of Mr. Soulsby's, and the Eclipse was coming off Wapping Point, and cut the barge down from the stern right chuck forward to her head; and I hailed them, I suppose, a dozen times to keep clear; I could not get the barge out of that road, and they will not stop an inch for anybody; he did not stop, and he cut the barge right down.

780. Did she go down under her?—No, we just got her home.

781. What harm did it do to the vessel?—Cut the barge right down, I suppose three feet.

782. Did her running against the barge do the vessel any harm?—The barge took one of the wheels.

783. Did not it break it all to pieces?—No.

784. Was it one of the large barges?—Yes, with 30 chaldrons.

785. With what speed was the steam-boat going?—Seven miles an hour.

786. Seven miles through the water?—Yes.

787. Had you 30 chaldrons of coals in your barge at the time?—Yes.

788. How much free board had you?—About a foot.

789. How could the steam boat cut your boat down?—It cut it along; it made it leak terribly.

Richard Downey, called in; and Examined.

Richard Downey.

790. ARE you a waterman?—I am a lighterman, we call ourselves watermen.

791. You do not ply a wherry?—Yes.

792. Have you experienced any inconvenience from steam-boats?—Yes.

793. Will you state what inconvenience?—There was one accident which sunk a barge loaded with stone.

794. When did it happen?—On the 17th of June.

795. From what cause did it arise?—From the swell; the swell completely rolled over her; the Harlequin and Adelaide were coming along together.

796. How much free board had you?—We had plenty to come to Mr. Johnson's wharf, which was all we wanted.

797. How much had you?—I suppose about nine or ten inches.

798. At what rate, in your judgment, were the steam vessels going at?—I did not see myself, but I have three depositions of captains, who say from eight to nine knots an hour.

799. Is this case for trial still; have you brought any action against them?—I mean to.

800. Have you made application to the Steam Company?—Yes; and the Harlequin says it was the Adelaide, and the Adelaide says it was the Harlequin that did it; they were both together racing one after the other.

801-2. What time was this?—Twenty minutes after nine in the morning, just as they started; they always race with each other when they go down.

803. Have you any other cases of your own to state to the Committee?—None that I know of.

804. Will you state at what distance your craft passed?—Close to them; we were alongside the ship; we could not go further.

805. You think that the steam-boats ought not to be near to each other?—No, they ought not.

806. Were they abreast?—No, they were close astern the one to the other.

807. You had two men on board?—Yes, and one of them was nearly drowned; even the ship's bow was nearly in the water.

808. Do you know of any others?—I have heard of some, but I have not witnessed any.

809. Do

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809. Do you often go in the barges yourself?—Yes, very often.

810. And have you had many accidents or inconveniences from steam vessels throwing water into you?—Yes, three or four ton; and if you call to them they will not listen to you.

811. Does the fact sometimes happen?—It does. I went to Mr. Hobler, who said he would fine them 10*l.*; and I went to the Thames Police-office, and they said that the Harlequin and Adelaide had done all the mischief to the boats, and sunk every one that had been sunk.

812. If the speed of steam vessels was limited to six miles an hour, would that provide for the safety of the vessels?—Six miles an hour will not do; if they make speed against a tide of six knots you may call it nine.

813. Did you ever see the effect of one of these boats going only six miles an hour; was your attention ever directed to it?—I do not know, for they generally go more than that.

Richard Downey.

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Andrew Walker, called in; and Examined.

814. ARE you a waterman on the river?—Yes.

815. What part?—Wapping.

816. Will you state to the Committee any damage you yourself have suffered?—I have received none; but I saw one on Whit-Monday last. I was rowing up Limehouse Reach, and I saw a steam-boat going up, I do not know her name now, and there was a wherry going, with seven or eight passengers in her, and on the occasion of the swell the boat upset, and if it had not been for the prompt assistance of me and another waterman, they would all have been drowned; I picked them all up, and landed them at the King's Arms, Millwall.

817. In your judgment, at what speed was that steam-boat going?—Ten miles against tide.

818. Above or below the bridge?—Below the bridge.

819. Do you know the name of the steam packet?—I rather think the Royal Adelaide. I do not know for certainty; I did not pay any attention to the boat at the time.

820. How was the wind?—Calm.

821. What number of passengers are you, in boats, allowed to carry?—Some four, some six, some eight; this boat was allowed to carry eight.

822. Where was the boat; was it very near the packet?—No; very far from it.

823. How far?—Four or five boats' length from it.

824. When they sunk?—Yes.

825. Whereabout, in what position, as compared with the steam-boat, was it; on the quarter of the steam-boat?—No; this was after the steam-boat had gone past.

826. Was there more than one steam-boat?—Not at that time; there had been two or three half an hour before.

827. Do you remember any other that you have witnessed?—I have not witnessed any other.

828. How many persons were in the boat?—There were seven or eight, I am not certain which.

829. Not more?—Not more, I am certain.

830. In the licence for wherries, does that number include the waterman?—Yes; eight persons without the waterman.

831. How many was this boat licensed to carry?—Licensed for eight.

832. That made nine?—That made nine, with the waterman.

833. You have not witnessed any other accident?—No, I have not.

834. Do you conceive that it is in the power of a waterman, when he has his full complement, to avoid all danger by getting out of the way?—This man put his boat up to the swell; the people sat very contented till the water came up to their arms; if they had moved they must have sunk directly; by that means we got the people out.

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835. How long have you been on the water?—Twelve years.

836. Do you ply below the bridge?—Yes.

837. Was the steam-boat a very large vessel?—She was one of a large size ; a Margate boat.

838. Was the boat very close when it passed?—No ; it was three or four boats' length.

839. Were they going the same way?—No ; the steam-boat was going up.

840. You are sure it was occasioned entirely by the steam-boat?—Nothing else ; there was no wind.

841. You have frequently seen steam-boats of the largest class pass by boats without occasioning any damage?—I have seen the water go over the head of boats, but they have not sunk ; even a light boat will do that with a rapid tide ; they go up frequently.

William Brown, called in ; and Examined.

William Brown.

842. ARE you a waterman on the river?—Yes.

843. Where do you ply?—In the most intricate part of the river, in the Lower Pool ; I have been there thirty years, and never was out of sight of the water.

844. State to the Committee if you know of any accidents that you have sustained yourself from steam-boats?—I have sustained some damage and accidents, but not while I have been in the boat ; while my boat has been lying in the stairs, she has been sunk and stoved, I can say as many as six or seven times by steam packets.

845. Within what period?—Within the period of the last two years.

846. Your own boat?—My own boat ; I have had two boats ; a large skiff was carried away and sunk.

847. In what situation was your boat at the time?—Lying upon the ground, with her head on the ground, and nobody near her ; that swell has gone quite over her.

848. Was that swell created by steam vessels?—Yes ; all steam vessels, as they go through the water with such velocity, the tide will recede from nine to ten feet down the shore, and before the boats have got time to rise again, the swell comes so quick, that comes right over the top of them and sinks them ; I have seen a ship's jolly-boat with four oars, and the captain in her, washed over and swamped, for they pass always within from 20 to 30 feet of us every day.

849. What particular part do you allude to?—Globe Stairs, about the centre of the Lower Pool, between Shadwell Dock and the Horseferry.

850. Do you know any other accident arising from steam-boats?—I have seen a number of damage done.

851. When the jolly-boat was swamped, was there more than one steam-boat passing?—There were three.

852. In your opinion were they racing at the time?—Yes, they were ; they were paddle-box and paddle-box when they came down.

853. At what speed were they going?—Ten or eleven knots through the water, I should suppose ; I have seen them in all parts of the river, my business carries me in all parts ; I served seven years to a pilot.

854. Do you know any one of the packets—any of the names?—Yes, the Royal George ; I think it was the Royal George, that day, and the Magnet.

855. Do you know of any other?—Yes, the Adelaide.

856. Do you know of any other accidents?—Yes, a number.

857. Will you mention any?—I saw The City of London run over another boat, I was about 100 yards off when the boat was sunk.

858. When was that?—I do not know, I think it was some time last year ; there was the captain and two boys, and one boy was hurt and went on the Grampus Hospital ; it went right over the boat, and the projected work of the boat struck the boy, and the things that were in the boat were lost, for which they made compensation.

859. You saw it?—I saw it, I was at the Horseferry, which is not more than 30 feet from where the accident happened.

860. Which way was the boat going at this moment?—The steam-boat was going down, it was in the morning.

861. Is the water shallow off the stairs you mention?—Very deep.

862. You

862. You say your boat was lying on shore; if she had been afloat, would she have been sunk?—She would not.

863. It is the custom to have a great number of boats fastened on the shore, is it not?—It depends on the tide.

864. The two boats were both going down?—Yes, that was a boat going down, The City of London.

865. How far do you say the small boat was from the shore?—From 100 to 140 feet from the land, near the middle; it was below the tiers.

866. What part of the river?—Between the Horseferry and the Wakes on the Rotherhithe shore.

867. Was that the proper channel for the steam-boat to take?—It is the regular passage; there is no other passage for any vessel, either steam or sailing, to take.

868. Was there anything to obstruct the sight of the people in the small boat, of the steam-boat approaching them?—None.

869. What was to hinder them from getting out of the way of the steam-boat?—I dare say they tried to get out of the way, but the speed of the steam-boat being so great, it overshot the small boat.

870. Did you mention of what size the boat was?—It was a ship's jolly-boat.

871. In your experience, was there anything sufficient to make the boat come down?—I should suppose the boat would carry two tons.

872. From your own experience of boats, is there anything to prevent a ship's jolly-boat rowing out of the way of steam-boats?—Sometimes they cannot help it, because there are obstructions in the way; but there was not at that time.

873. Whereabout is Horseferry?—Very near facing the Regent's Canal.

874. They were outside of the tier of vessels?—It was below the tier of vessels; there is never anything lying there but light vessels taking in their ballast, or vessels bound to the London Dock, or other places.

875. There was nothing in the way; such as tiers of vessels?—Nothing; it was in open water.

876. Did the people in the small boat seem endeavouring to get out of the way?—Yes, they did.

877. Were they rowing to one shore, or the other?—I think a great deal of it was owing to the people being frightened.

878. You have said that the people in the small boat were endeavouring to get out of the way?—By rowing.

879. In which direction were they rowing?—Both going down.

880. You have said that the people in the small boat were endeavouring to get out of the way of the steam boat by rowing. Were they rowing on one side or the other?—When the steam-boat was coming, they might steer to that way or the other.

881. Which way were they going?—They were endeavouring to clear the steam-boat, so that the steam-boat might pass.

882. Which side were they pulling?—Towards the south shore.

883. Do you recollect what ship the jolly-boat belonged to?—No, I do not.

884. If the small boat had begun to alter its course in time, do you think there was any obstruction to it. You would have endeavoured to get out of the way?—Yes, I would; I would have rowed further off.

885. Which those people did not do?—I cannot answer that.

886. The captain had his helm in his hand, and they did not row out of the way?—They rowed in an angle to the course of the steam-boat, but it came in contact with them.

887. Which way was the tide coming?—It was coming down.

888. They were endeavouring to keep in the strong tide?—I do not know whether they were endeavouring to do that; the tide runs very equally there, unless it is close in shore.

889. Were their paddles stopped?—No; their paddles were not stopped till after they came so close to the boat that they saw her, and they stopped the speed of the vessel.

890. In the middle of the stream?—In the middle of the stream.

891. Would you have remained in the middle of the stream if you had seen a steam-boat coming upon you?—It is a constant thing to do; because it is a thing as likely that the steam-boat will see the boat, as the boat will see the steam-boat.

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892. Would you not have gone to one side or the other?—Yes, I should have ported my helm.

893. Would it not have been more easy for the small craft to have moved than for the steam-boat?—I should consider it the rule of the river, that the small craft should give way to the larger.

894. Have you not stated that the small boat did make an effort to get out of the way?—Yes.

895. And the steam-boat made none?—Yes.

896. If that effort had been made in time, it might have saved the boat?—Yes; but being a foreign captain, the vessel shot upon him before he could get clear of her, and he was not aware of the speed at which she was coming.

897. You said something about the swell drawing in the boat, did the swell draw her in?—I believe the question was asked me whether, when I was in the boat, the swell drew it.

898. You said, if it had been an ordinary captain who had been accustomed to navigate the Thames, he would have known at what speed the steam-boat was coming, and have got out of the way?—Yes, it is the rule; 100 yards before she comes he will get out of the way of her.

899. Were the people all saved?—Yes, all were saved, except the boy was hurt, and carried on board the Grampus, and the ship sailed without him.

900. Did the steam-boat come stern on?—No; the projection work of the paddle-box took the boat; the boy trying to fend the boat off from going under the wheel, struck his shoulder.

901. Did the steam-boat make any attempt at all to keep out of the way?—No, I did not see the steam-boat alter her helm, she kept a straight course.

902. Could you judge of that with so large a vessel?—Yes, no doubt of it.

903. Your position is, that whereas the small craft made effort to get out of the way, the steam-boat made none at all?—I never saw her do it.

904. Must you have seen her, if she had done so?—No, I did not.

905. What interval of time elapsed when the boat was in danger?—They stopped the vessel when it was in danger.

906. How long before the accident occurred could you have seen the danger; could you see it?—Yes.

907. You said just now, if it had been an English captain, he would have got out of the way; might not the captain have supposed that he was getting out of the way?—No doubt he hailed them.

908. Did he hail them?—There was a great noise on board, I was not close enough to hear what was said, I heard them sing out to pull the boat out of the way.

909. Did you say that the other boat had time to get out of the way?—Yes, I consider that they might.

910. What distance were they from the vessel when they stopped the paddles?—I do not suppose that they were 10 feet.

911. Was there anybody on the paddle-box?—One upon each side.

912. What was your position with respect to the steam-boat?—I was in a boat rowing along shore.

913. What position were you in; upon the head of the steam-boat?—Rather astern of the steam-boat; the steam-boat had passed me as I was coming down. I was on the quarter of the steam-boat, upon the starboard quarter.

914. Was the boat that was run down on the same side?—On the starboard side.

915. On the same side as you?—Yes, both on one side.

916. Suppose the vessel had been under canvass, and the captain had kept his course, would the same thing have happened?—I consider not, because there is not the danger under canvass, owing to the projection of the paddle-box; if you clear the bows of the vessel, you come into contact with the paddle-box.

917. Do you suppose that there was any suction of the smaller boat to the other boat?—No doubt of it; if you miss the projection part and go anywhere beneath the swell of the wheel, you would sink the boat.

918. In this case was there any suction of that same boat?—No suction of that, because her damage was done with the projection works, and the wheel was stopped.

919. Then

919. Then there could have been no suction in that case?—No, but I understood the question whether there was any suction in steam-boats, and I said yes, the suction of the wheel will sink the boat.

920. The Committee understand you to say that at all events the accident might have been prevented with due care?—I have not a doubt that it might have been prevented.

921. Due care on the part of whom?—Both parties are to be considered in blame. I have seen a great many more accidents besides this; I dare say I have seen as many as 30 accidents.

922. Do you know any one in particular that you yourself saw occasioned by steam-boats, in which in your judgment there appears to have been a decided fault on the part of the steam-boat, and in which the other vessel was injured, and no fault could be attached to it?—I saw one in which the daughter of Captain Smith, of the Surrey Canal was in; she was coming up from Margate. They called a sculler to come alongside off the stairs; it was during last summer, I think it was about the month of July; and when the boat was hailed, a young man of the name of Walker came alongside, and before well the lady was in the act of getting down the ladder to get into the boat, the steam-boat set her works to play, and she went overboard.

923. Off the vessel?—She had one foot on the ladder and the other on the boat.

924. She fell off the ladder?—One foot was upon the boat and the other on the ladder, they would not give her time to get into the boat, and the boatman almost fell; they put on the steam too soon.

925. That was a thing that might have been prevented with care?—Yes; that was on Monday.

926. Have you ever seen any boat run down?—I never saw a vessel run down by a steam-boat.

927. Do you think that the accident which took place by the steam vessel damaging another vessel would not have happened if that vessel had been a sailing vessel?—I have seen numbers of that kind.

928. Can you recollect any of that kind?—Yes, I recollect barges; I do not know who the barges belonged to.

929. Do you recollect any particular barge?—I do not know the name of the barge.

930. Can you mention any accident which occurred to any barge?—The last case I saw was a barge lying at Stone Stairs tiers.

931. Will you describe to the Committee what happened upon that occasion?—The barge was alongside of the tier, and the steam-boat was coming down, there were two steam vessels, the Royal Adelaide and another, and they threw such a body of water into that barge that I suppose I might say four or five ton, or it might be more, and they got that barge close to the shore, and then it sunk; but who the barge belonged to I do not know.

932. What was the barge loaded with?—Loaded with coals; they got her ashore close to the Horseferry.

933. Was she deeply laden?—She was not over laden; I dare say she had as much as 16 or 18 for the burden.

934. Were those two steam-boats going down together?—Yes, paddle-box and paddle-box.

935. And they consequently created a great swell?—The swell took the bow of a loaded collier called the William and John, and went over the forecastle.

936. When was this?—In this year; and I saw the swell, but not sinking of anything, by the Royal Adelaide last Saturday.

937. There were two steam vessels upon this occasion?—Yes.

938. Were they going at any great rate?—I should suppose between 10 and 11 upon the ebb tide.

939. If there had been but one steam vessel, do you think that so much swell would have been made as to have swamped the barge?—I consider she would, if she had come with the same velocity as they both did.

940. Why do you suppose that?—I should consider that two would not make more swell than one.

941. Do you suppose that if the steam vessels had been going at half the rate they did go at, they would have created less swell?—Not a doubt of it; I have

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seen them going at all speeds in the Pool; because there is the Swiftsure, she will go up the river, she will have from 15 to 20 fathoms of rope, towing six or seven hundred ton ships, to the St. Catherine's or London Dock; and she will go through the Pool without any damage either to the ship or herself.

942. Why not?—By not going so fast; she goes easy, about two knots through the water.

943. Did you ever see any accident occasioned by the swell of a single steam vessel?—Yes, I have seen as many as a dozen boats; I saw three boats almost sunk by the Royal Adelaide last Saturday at 12 o'clock; the Dart was going ahead of her, she had passed about four minutes, when the Adelaide came down, and she was going her full speed, or very near upon it.

944. Had the swell that the Dart made subsided, before the Adelaide came up?—She made very little, she was going down very easy, she was not going above one quarter speed down the Pool.

945. Do different steam vessels create a difference of swell in the water?—Yes, some a great deal more than others; for instance, there are the Irish steam-boats, which make a swell, most of the swell is a dead swell behind them, they never throw any swell from the sides of the vessel to the shore, but they make a broken water, which you may very well avoid. In Gravesend Reach the swell will never subside till it reaches the shore.

946. It is not till that swell breaks that it is dangerous?—Not at all; when it comes to a third object it is sure to suffer; if you are coming down the river, and a steam-boat is either coming up or going down with an empty boat, the swell from the steam-boat will drive you right to the ships, and when it comes to the ship's side, that breaks the force and drives it back again to the boat.

947. In the former evidence you gave about the accident which happened to the ship's jolly-boat, did you say there were two tons of goods on board?—No, I said it would carry two tons.

948. How much were there in the boat?—I do not know; they were all lost; the boat was big enough to carry two tons.

949. Will you detail to the Committee any accidents that you have seen yourself by steam-boats?—I have seen a steam-boat having so much way, that she carried away her own mast, and threw a man overboard.

950. Did you ever see a steam-boat do any damage to any persons?—I have seen her carry away her jib-sails; I never kept a memorandum of them; I have seen women chucked overboard, and boats swamped.

951. You say you have seen women chucked overboard and boats swamped; have you seen any other accidents of that description than those you have already detailed to the Committee?—These accidents have not been by the steam-boats striking; it has been owing to the swell rebounding from the shore and sinking the boats.

952. Of that description of accident have you known any more, which you have not detailed to the Committee?—No; there have been many cases of the same kind.

953. Are there any more than those you have already detailed to the Committee?—I saw The City of London on the very Friday after the Monday that the woman was thrown into the barge, a barge was run down, and the man was picked up between the vessel and the barge.

954. Detail particularly how that happened?—The wind was easterly; it was right off Globe Stairs, rather below it; the sailing barge was working down, full, with the wind easterly, standing to the southward. The City of London was coming up the river against the tide, and she ran into the barge, and knocked a man overboard upon the side of the barge; the man was picked up between the barge and the steamer's head.

955. Was the river about the barge very much crowded at the time, or was there room at the time for the steam vessel to pass?—There were several vessels at the time working down, as is the case at that time of the tide.

956. Was there room ahead or astern of the barge for the steam-boat to have passed?—There was no room ahead of the barge but plenty of room astern; she struck the barge.

957. Did she strike the barge with her stem?—With the stem.

958. Are you aware whether the men in the barge called out to her?—No; I was not close by.

959. What

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959. What pace was she going at the time, before she struck the barge?—I suppose she might be going seven or eight knots through the water.

960. What way had she when she struck the barge?—They shoot sometimes two or three times her length.

961. How fast was she going when she struck?—Four knots when she struck, although her wheels were not going at the moment.

962. What damage did the steamer herself sustain?—None by that, as I saw.

963. She did not carry away her stem, or her bowsprit?—No; nor I did not see that she hurt the barge; the helm flew over and knocked a man overboard.

964. If the steam-boat had stopped her paddles about two or three minutes sooner, she would probably not have struck her at all?—Not a doubt of it.

965. Had she just come round a point, or had she been in sight all the time?—No. Globe Stairs is about a quarter of a mile from the point; there is nothing to obstruct the view from one end to the other.

966. Was the steam-boat coming up at full speed?—I do not know.

967. How came she to strike the man overboard?—By striking the quarter of the barge it knocked the man overboard.

968. Do you recollect any other accident?—No, not to call to mind; much the same things.

969. How do you account for that accident; from the negligence of the captain or not?—No; from the overspeed of the vessel; because when a man is working down the Pool he is obliged to go as the tide carries down, and the steam vessel coming up has opportunities that she can stop herself at any time.

970. Was it from the negligence of the captain, or from the bad construction of the steam-boat, that this happened?—I do not think there was any negligence; she might have gone astern of the barge; there were three vessels under weigh at the time, and they were all standing to the southward.

971. Might not that accident have happened to a sailing vessel?—It could not, because there was not wind enough to run a sailing vessel against a vessel of that description with that force.

972. Suppose there had been?—I do not think it would have happened, because the vessel would have kept further from the land, and drawn more water.

973. Might not that accident have happened to a sailing vessel, if the wind had been favourable?—Yes.

974. Was there anything in opposition between a sailing-boat and a steam-boat, that would not have thrown the man overboard in both cases, if they had struck the boat?—Yes, it was the shock that did it, and any vessel that had equal speed would have knocked the man overboard.

975. Have you known accidents from vessels going before the wind?—I have known it, but not very often, because most sailing vessels, when they come into the Pool, shorten sailing.

976. You would consider that a steam-boat is more manageable than a sailing vessel?—I consider she is more manageable than any craft on the Thames.

977. Therefore there is less probability of accident occurring by steam vessels than by sailing vessels?—I do, indeed.

978. What is your reason for that opinion?—A vessel under canvass, up and down, running either in the Pool or any other place, if she is likely to run into any other vessel, will naturally let go their anchor, and by swinging on that anchor, she may strike a tier, or something of that kind.

979. During the time you have plied on the river, what part of that time have steam vessels been plying?—The first steam vessel that I saw ply on the Thames was the Margery.

980. Since steam vessels have begun to ply on the river, have you witnessed more accidents from steam vessels or by sailing vessels?—By steam vessels; when steam vessels first came up, there were not so many accidents happening.

981. How do you reconcile that?—Because they used not to go at such a rate; and from their great speed, at different times of the tide, they are sure to meet with more accidents; there are every day now 15 or 16 steam-boats running up and down at a certain hour, whereas the tide in this river alters every day about 20 minutes, which sometimes brings it into contact with high water, and sometimes with low water; and when it is high water there is a great quantity of craft and vessels under weigh at one time, and that is the cause of the great mischief that is done; but if steam vessels went as other vessels, there would be little accident.

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982. Then as long as steam-boats are used upon the Thames, there must be these accidents?—I do not know that.

983. Would not accident be prevented by limiting their speed?—I am perfectly sure of that.

984. To five or six knots?—I do not know that; it is very well against the tide, because I do not consider the tide to run more than four knots.

985. You think if the speed were limited, damage would be prevented?—Yes.

986. Do you know how soon a steam-boat could be stopped, going at the rate of 10 miles with the tide?—They can stop the machinery instantaneously, but they cannot stop the way of the vessel.

987. Do you know how soon the way of the vessel would be stopped, going at the rate of 10 knots an hour?—From 50 to 60 feet in still water. I cannot exactly say how far they might run before they would do damage, she would go pretty nearly the rate that she went at first; the back water is just as it was going through the water the opposite way.

988. You have given an opinion, that if the velocity of steam-boats were limited, there would be fewer accidents; that, of course, must in one sense apply to the facility of stopping them?—No; in the evolution of the wheel round, if the wheel was to go round easy, it would naturally propel the vessel forward.

989. You have given an opinion, that accident would be prevented, if the speed of steam-boats were limited?—Yes.

990. Do you know in what space of time, or distance, a steam-boat going at the rate of 10 knots an hour, can be stopped; how much further would she go after stopping the machinery?—If they stop the wheel in still water, I do not suppose that the steam-boat would run more than 100 feet.

991. In what space could she be stopped if she was going at six knots an hour?—I should suppose in half the distance; because as soon as the wheel is stopped the force of the vessel through the water makes a dead drag against her.

992. Suppose a vessel was going 10 miles an hour, what effect do you know the reversing of the machinery would have upon her?—No, I have never seen it tried.

993. What is the limit of the river from London Bridge, within how many miles of London Bridge would you recommend that the speed should be limited, do you recommend it should take place in the entire river?—From London Bridge to Cuckold's Point.

994. If the limitation of speed were to be between Cuckold's Point and London Bridge, you think, in all fair probability, the danger would be avoided?—Not a doubt of it; that is where the great traffic is. I have seen as many as 100 vessels from the short space of the London Docks to Cuckold's Point, all together, barges and sailing vessels, either low water or high water, it is like a crowded street; that is a narrow part of the Pool, it is never more than 120 feet to come through.

995. From Cuckold's Point to Greenwich there is no necessity for any limitation of speed?—There is more room.

996. You think there would have been the same swell?—Very near the same, if they were to come at the speed they were coming.

997. Suppose a single steam-boat came at the rate of six knots, do you mean to say that that steam-boat would occasion as much swell as two steam-boats at the same speed?—Very near the same; because the two boats being together, they throw off from each side their swell. The greatest swell that occurs is when there are three or four astern of each other, then they keep a continual swell up.

998. You have been stating, that in your opinion accidents would be prevented if the velocity of steam-boats were checked; can you state to the Committee, from your own observation, whether any accidents have happened which have come under your observation, from the velocity of steam-boats, which, going at a certain rate, would not have happened?—Before steam-boats went at the rate they do now, I never saw so many accidents.

999. Do you mean to say that they went slower before?—Yes, about 12 or 14 years ago I have been to Margate in nine hours, and now they are not that

1000. Do you mean to say, that the velocity of steam-boats going through the Pool now, is increased to what the velocity was eight or 12 years ago, when they used to go?—Yes, I do. There was the London Engineer, which was as large

as that now, and that boat used to go much slower.

1001. Any accidents, that you have witnessed, occasioned a loss of life?

1002. A loss of life from steam-boats.

Mr. *Joseph Turnley*, called in ; and Examined.

1002. YOU are Master of the Waterman's Company ?—Yes.

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1003. Will you be good enough to state to the Committee any accidents within your own knowledge that have occurred from steam vessels on the river ?—I will name all that have come within my knowledge. About eight years ago I was going to Margate with the Hero steam vessel ; there was a fisherman off the Isle of Dogs in his general business, and from some cause or other he made towards the shore, considering that he might be in danger, but before he could get there the boat ran over him ; the men were thrown overboard, but they were saved, and the boat and all the traps went together. That is the only accident which I have witnessed, with the exception of one coming through the Pool. I came up in the George the Fourth from Gravesend, between two or three days of the last of July ; I had been down officially for the Company's business. This was coming round Cuckold's Point. The two Margate boats were following hard after one another, and there was a boat going with a stack of corn and some tarpaulings over it, and I saw the swell go up the side of the stack about 18 inches, if the tarpaulings had not repelled the water and cast it back again, that barge must have been swamped in the meantime. I have seen several wherries in that convulsion, that had any of my family been in, I should have been concerned for their safety. Those boats were racing one after the other, our boat was a boat of less speed, and consequently they went by us, and after we had put several passengers out, it was a miracle they were not swamped, and that is the general experience of steam-boats, as far as my observation has gone.

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1004. You yourself see a great deal of racing between steam vessels ?—I do. I might mention another circumstance: I was coming from Margate in the Ramona ; when we got into the Pool there was a vessel ahead of us, and anxious to get forward, she ran ashore on the Point, and then as we went by there was an huzza, and all the Pool was in an uproar, and so much were we occupied in the other vessel, that we ran into the tier, and there we were stopping everything ; when the steam vessels get into the Pool, their length is such that if you put them out of the line they cannot get in again, they become mischievous to themselves and others.

1005. Did you ever see a boat that was afloat swamped by a steam-boat ?—I only speak from passing up and down, and seeing steam-boats.

1006. You never apprehended danger ?—Yes, I have seen the water going into them, and that is pretty near danger.

1007. Have you ever seen any boat swamped ?—None but that that was run over.

1008. A sailing boat might have done the same thing ?—A sailing boat might have done the same thing, but I am free to say that I have never seen any accident in my life from a sailing vessel, from the circumstance that I am about to mention ; I take upon myself to say that I would take my wife and family, and pass by a ship of 400 or 500 tons, and there is nothing to fear, but the great fear in steam-boats is when you have passed the steam-boat, then the mischief begins.

1009. You are master of the Waterman's Company ?—Yes, I am.

1010. And you have been for the last two or three years engaged in its concerns ?—Particularly so.

1011. Do you happen to know whether people go in the boats as heretofore, or is the number diminished ?—I know to the contrary ; I know that the complaint before me in the court is that the privilege is not worth a penny.

1012. Do complaints come before you ?—Yes.

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bably it has ; but looking at men going upon business, which below they are much obliged to do, they are in the habit of coming round the bridge rather than to risk their lives by going across in a boat, and it is a general observation along shore amongst the tradesmen and respectable men, that they will go any way rather than cross the water.

1018. Then your observation is confined principally to those who cross the river ? —There cannot be so much labour.

1019. Have not those boats which ply up and down the river diminished a great deal from the steam-boats having carried off their passengers ?—There is no doubt that it has diverted the trade ; they now can go for less money and see more, and go more quickly.

1020. And of course that is a reason for the diminution taking place ?—Yes.

1021. You have stated that the rate of speed at which steam-boats go occasions the swell, and you have stated that if the speed were diminished it would be prevented altogether ; does not the evil arise from the very slight construction of the wherries ? Suppose a legislative enactment were to oblige the wherries to be built higher and stronger, so as not to be so easily affected by the swell, would not that obviate the evil ?—Yes, but it would damage all the trade of those boats ; if you were in the habit of going quick you would not like to go slow ; the end of those light wherries is to go quickly ; if they were built so heavy they could not move against the tide.

1022. You say, that as master of the Waterman's Company you know that the communication across the water by the boats is much diminished ?—I meant that to apply to passengers, and not to boats.

1023. Assuming that there is a diminution, and that you have the power of ascertaining that diminution, have you had an opportunity at the same time of ascertaining this fact, that it is in consequence of accidents happening by the steam-boats, or a mere undefined fear ?—It is by real accidents themselves, it is as common every week to hear of men being overboard as it is to see the morning light.

1024. Do you hear of such accidents ?—I have such accidents before me every week.

1025. During the 50 years of your experience, has not the construction of the wherries which ply about the Thames very much lightened ?—The boats above bridge are more or less so ; that is in consequence of young gentlemen having boats built very light, and when they are tired of them they sell them to watermen for a song, but when they come to us there is a scale laid down for four, six, and eight ; we lament very often that we are constrained to give, according to the Act of Parliament, a licence to the boat ; we consider that from the shallowness of the boat it is hardly fit for a passenger to come in, but this is one description of boat above bridge.

1026. Do you mean to say that those boats never come down below bridge ?—Yes, and it is lamentable that they should, many of them, but they take fewer passengers.

1027. You said that you attributed the accidents that had happened entirely to steam-boats ; you now state that the very construction of the boats have become more frail, and not so substantial, and more dangerous to navigate now than they were ?—When you speak of boats being frail, you must confine yourself to a certain quantity of boats that are above bridge.

1028. Which are the boats to which you allude as suffering accidents ?—They may be ; I only know from those coming to the office or complaining to our court ; it has not occurred to me. These was a boat sunk at the Point, where I think two men were drowned, where she was licensed for eight.

1029. Are the boats that are licensed for eight, of the same description of boats that you remember carrying eight, as long as you can recollect ?—They are quite as strong, but in many cases they are a little sharper. The law requires that such boats, from the rise of the floor should be two inches and three quarters ; it so happens very often that they exceed three inches.

1030. Being a little longer would not affect their safety ; is she as high out of the water at the sides, and has she as broad a beam and as much stability as the boats you remember ?—Quite ; in many cases they are wider, but we do not consider them a bit better ; our scale is four feet six, the law allows us not to licence unless she is four feet six, and three feet wide.

1031. Was

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1031. Was that the law when you began?—There was no law at all.

1032. How did they build wherries then?—In some cases they were lighter, and in some cases flatter boats, considered more safe; but at that time they did not frequent the water as they do now; there was not that commerce and business; in days that are past men went on steadily and slowly, now dispatch is the order of the day.

1033. In point of fact, independently of steam-boats, do the wherries that are built in our days below bridge, suffer more accidents than they did?—No, those are things which seldom happen; except it is some extraordinary case, as that in the night there has been a high wind, or something else, it is never known that wherries are swamped; I myself when I was a boy sunk a dozen myself by stepping over them from a boat, with such an accident as that, but in the general way, the boats lay ashore undisturbed, but every time now the steam vessels send the swell ashore.

1034. The question does not refer to steam-boats at all; you say that there has been an alteration in the construction of the wherries within your remembrance, that formerly they were made to go safe and sure, now that speed is every thing, and they are made to go fast. The question is, whether the new Bill that you allude to, to give speed to them, has diminished their safety?—I think not, because there is a difference in some boats; a very considerable number are as they used to be, as large as they were, and not a bit swifter than they were.

1035. With respect to those that are swifter, those that have got this new addition to them, have they become less safe?—According to my position they cannot be so safe as others, but I have never met or heard of accidents in consequence of that.

1036. You have not heard of any accidents happening to wherries from their present build, independently of steam vessels?—No.

1037. Are the number of wherries increased of late years?—I consider considerably.

1038. In what proportion do you suppose that they are increased, a sixth more?—I should think, may be there is one-third more since I have been in business. It is accounted for in this sort of way; the watermen have no sort of means of putting their sons to business, except to the water, and as soon as they have served two years, they buy them an old boat and they go to work themselves.

1039. Does not the demand for them increase with the increased trade of this metropolis?—No, since the docks receiving ships in every direction, instead of the Pool being so full that you can hardly get a barleycorn through it, there is less custom than there was.

1040. You say you licence three descriptions of boats, one for four, one for six, and one for eight. What is the free board which they have when they are laden with that number of passengers?—It will depend upon whether the boat is high-sided.

1041. What is the free board of each separately?—I should suppose they might be six inches out of water.

1042. You have alluded to a particular case of accident; is it in your recollection any of those accidents happening, and upon investigation you found it to be those shallow boats?—No, I never met with such a case.

1043. Were those boats which you now license to carry six, and those which you license to carry four, formerly in existence at the time you alluded to, in the early part of your knowledge of the river?—I should think it is more than likely that they were; I consider that those were confined above the bridge, because they did not get fares below, and they found it their interest to have a small boat in order to go quicker; it pleases gentlemen, though it frightens ladies.

1044. Did that small description of boat exist above bridge?—My business was never above bridge, but my belief is that there was such.

1045. The boats that ply above bridge sometimes come down into the Pool, do they not?—It is more than likely.

1046. If the boats now above bridge do that, they did the same formerly?—Yes.

1047. And you have no recollection of having seen any below bridge?—I have no distinct recollection to particularise any one.

1048. With regard to the accidents which you know of, have they happened more particularly to the vessels of that small description of boats, or is it with the

Mr. Joseph Turnley. common wherry below bridge?—Principally those that have been carrying eight, because they are poor men, such as porters and so on, that fill a boat with eight; you may see plenty of boats without seeing eight in them.

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1049. Those wherries which ply with that great number of passengers, ply above bridge; there are very few of them below Greenwich?—We allow them to carry eight, because they carry a great deal of luggage.

1050. They are a different kind of boats?—Yes, strong boats.

1051. Are you aware what effect a steam-boat would have upon that description of boat which plies from Woolwich?—That would depend a great deal upon her loading.

1052. If she had only passengers?—I think she might be able to meet all she would have to meet.

1053. What would be the objection to having vessels of that kind entirely below bridge. If all the wherries of London were confined to that class, what would be the evil; would they draw too much water?—They would be so ungovernable, that two men would not be able to row her up; the ships row with the tide.

1054. Then they would not be able to go up?—No, certainly not.

1055. Do you know how high the gunwale is above the water, when she has no luggage?—May be she carries 12 inches.

1056. The first accident that you ever saw occurring from a steam-boat, was when you were in the Hero, when you ran against the fisherman's boat?—Ran over the fisherman's boat.

1057. Was not that man trying to get out of the way?—I conceive so, from his act.

1058. And in doing so he ran across your course?—I rather think it depended more upon the steam-boat than upon him, for he had an anxiety to get out of the way; but steam vessels fly away, and they stop for nothing.

1059. Then the fisherman's boat had tried to avoid the steam-boat?—He did.

1060. Would the accident have happened if she had kept her course?—The steam-boat was in the wake of the ship, and he strove to get out of it.

1061. Had not the fisherman tried to get out of the way, the steam-boat would have been obliged to have gone round it?—He, like every other man, saw the danger, and he tried to get out of it; but he got into it. If there had been a proper look-out on board the steam-boat, and just passed the word to ease the helm a little, a mere trifle, would have escaped the boat, but instead of that, they came into contact with the other, and away they went.

1062. There would have been every facility to have avoided this boat, but it was carelessness on the part of the steam packet?—I conceive so.

1063. Then this accident arose entirely from carelessness?—Yes; for there was nothing in the way.

1064. And not merely from the fact of the vessel being propelled by steam?—No, certainly not.

1065. Supposing you had been in a sailing vessel instead of a steam vessel, and that this sailing vessel had been in the wake of the boat, as you have described the steam-boat was; supposing in each case the parties in the sailing vessel and the steam vessel had seen the man, and had not wished to run over him, which would have avoided him the most easily?—I should think, from the velocity with which the steam-boat was going, she would have answered her helm more easily.

1066. You think if proper caution had been used the steam-boat might have avoided the boat better than a sailing boat?—Yes; because she would have answered her helm more readily.

1067. Do you know whether the steam-boat was altering her course?—It is a length of time back, and I cannot speak as to the minute circumstances; I never expected to be called upon to relate them again.

1068. Supposing the steam-boat was endeavouring to go to the starboard side, and was endeavouring to take sufficient caution to avoid the boat, the other man might turn suddenly to that side also, and run right in the way of the steam-boat?—It is quite certain it might be so; I saw an action of that kind; I was coming up Half-way Reach, a collier was running down against the tide, there was a boat with four men and three women, they had got a small sail, and they tried to keep her on the side of the collier; but, just as they got pretty near it, their courage failed them, and they put the mast at the bottom of the boat; they ran against the collier, and five out of the seven were drowned.

1069. You

1069. You stated that the other accident which you saw, was a vessel getting into a tier?—Yes; I only mentioned this to show the effect of this stimulus; the headmost boat ran ashore on the Point, and then there was a general hurrah, and we were so attentive to this, that we ran into the tier before us.

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1070. You do not consider the accident to have occurred from the use of steam?—No; I consider if there had not been this stimulus to make this boat get before the other, the boats would have gone along, and not come against the tier.

1071. How fast were you then going?—From eight to 10 miles an hour, I dare say we were; and as we came along the other vessel, much quicker.

1072. Do you attribute that last accident to the use of steam, or to the carelessness only of the steersman?—It must be to the indifference we were in to the vessel, in trying to get by the other vessel. If caution and care had been used, neither one of them would have been in the position they were in.

1073. Might not the same accident have happened to a vessel under sail?—That the vessels get on the Point is notorious; but they have a very different feeling in coming up; they wish to get out of harm's way.

1074. Before steam was in use at all, did not the Gravesend boats run races with each other, and practise as much joy if an accident took place with one, as now is practised with steam-vessel people?—I think I can say that I never saw an accident with the Gravesend boats; I have seen them go in narrows where I could not go myself.

1075. Did they not use to run races?—Yes, they were always racing; they could not go without racing.

1076. If those two vessels had been sailing vessels and not steam vessels, and one had stuck upon the Point, and the other had been looking at his adversary and hurrahing, might not the sailing vessel have run against the tier?—It might, of course, but I never saw that desire in sailing packets ever to outrace one another in that manner.

1077. How fast have you seen sailing vessels go, when they have got into the Pool?—Not above five miles an hour.

1078. You say that a great number of accidents have happened from the use of steam-boats. Have the greater number of accidents occurred from the velocity of steam-boats, or from the competition of the watermen, in wishing to come aboard to get passengers?—Without they have a signal to come on board, they never come at all.

1079. In your knowledge of the navigation of the Pool, have a greater number of accidents happened to those wherries, from the velocity at which those steam vessels were going, or from the crowding together of the boats, either when she was on her way to her moorings or at her moorings?—Certainly several accidents have happened when she has got to her moorings, but when she is not, one or more will try to come off when beckoned, but then she will stop her speed, because it would be folly for any boat to approach a steam packet, unless her wheels were stopped.

1080. Have the greatest number of accidents which have happened, occurred from the velocity with which the steam vessels were going, or the crowding together of the boats?—Certainly, from their velocity of going through the water, more accidents.

1081. Do you know of your own knowledge, that before steam-boats have come to their moorings at the Custom-house quay, a number of wherries have been crushed, by six or eight hanging on to the steam packet?—I never heard of it in my life.

1082. Eight or 10 years ago?—Eight or 10 years ago there was nothing like the mischief there is now.

1083. Eight or 10 years ago, do you know the fact that several wherries were crushed by the reprehensible practice of clinging on to the steam-boat?—No; I never heard of it in my life.

1084. You have described the danger of steam-boats, in consequence of the rapidity with which they move; would that danger be diminished if the speed were limited?—There is no question about it; it is possible for them to come through the Pool as other craft, if they are only forbidden to go so fast as they now do.

1085. Would it not also diminish the danger, by following one another at a certain distance, with regard to the Pool?—It would be certainly desirable that no steam-boat should pass another while she is taking up passengers.

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1086. Is the danger increased by their following each other?—Not at any reasonable distance; suppose they are 100 yards apart, but it increases from their being near.

1087. Is it increased from their going paddle-box to paddle-box?—Clearly so; they make a sort of double swell.

1088. Have you heard of many accidents happening to vessels at their moorings?—Yes.

1089. Has not the frequency of such accidents been obviated by watermen adopting a different plan of watering?—They have not.

1090. The usual way of landing is to land at one spot?—Yes.

1091. Have not the watermen obviated the accidents which occur, by adopting a different system of leaving their boats entirely in the water, instead of leaving them half dry and half wet?—In many cases they have a stave to fasten their boats; that is attended with a vast deal of inconvenience, because they have to stop when they have passengers to unfasten their boats.

1092. That has decreased the danger to the boats?—Yes, but that cannot take away the inconvenience when a man lands his boat and the steam-boat passes by, and the man merely runs to get change, and when he comes back finds his boat swamped.

1093. Supposing the boats used below the bridge were in construction similar to those which you call the Woolwich boats, would any accident happen to them?—I do not think there would.

1094. Would those boats be able to be rowed against the tide?—Not at all.

Mr. William Morgan, called in; and Examined.

Mr. W. Morgan.

1095. WILL you have the goodness to inform the Committee, as you have taken great interest in steam-boats, whether you have seen or known of any inconvenience arising from steam-boats?—It is too notorious to admit of doubt. I have been exposed almost to be drowned in the river.

1096. Will you state to the Committee the case you allude to?—I was in a wherry just below Rotherhithe; it was The City of London steamer going down the river, and from the swell from her passage in the water we were very nearly swamped; we shipped a great deal of water, and had we not pulled immediately for the shore we should have been swamped.

1097. Are you aware what description of wherry that was?—It was in one of the larger wherries, such as are used mostly below bridge.

1098. Was there any other person in the boat?—One person.

1099. Was the boat rowed by one person or two?—By two men.

1100. What in your opinion, as steam-boats are now constructed, do you suppose would be the best precaution in the Pool, and in those crowded parts, to prevent the accidents that occur?—A reduction of the speed at which the steam-boats are allowed to travel.

1101. What would be the most convenient way of arriving at that object?—I am only aware of one mode, of shutting off the steam by a throttle-valve.

1102. Could you imagine any mode by which that might be indicated?—There is no difficulty in connecting the lever by which that throttle-valve is worked; it is usually worked below, but a connection from the crank by which it is worked could be carried to an index on deck or in the larger cabin.

1103. What would that indicate, whether it was half open or a quarter open?—Yes, it might be confined to the valve passage, and it would then show how much of that passage was closed.

1104. If the Committee understand you right, supposing the engineer be ordered by the captain to reduce to half speed, and he was therefore to think it necessary to let off one third of the steam, he would move in the engine room the throttle-valve, to let off that portion of steam; and you conceive that if while he is so doing there were a connecting rod which would point to an index on the deck, that would show what he was doing in the engine room?—Yes.

1105. Would not the greater or less intensity of the steam have an effect on the vessel?—Yes, if the throttle-valve is not sufficiently closed, and the intensity of steam in the boiler is very great. There is no question the sharper the steam the more rapidly it will travel, but then, according to the number of revolutions which that will make, he must close that more or less until reduction is obtained.

1106. Then

1106. Then it is a necessary consequence, that because it is closed one half, the speed would be reduced one half?—Yes; I proposed that this index-valve should be so created, that it might show the quantity that was left open, and if he had not closed it sufficiently in the first instance, the rod would be drawn further and further, until the necessary diminution were effected. I would mention that plan of the index simply because it has been suggested that they might not comply with the demands, and any person might see that he is doing that by this means.

1107. To obtain a perfect index, it would be necessary to have a gauge for the steam?—As regards the safety of the vessel that might be as well, but as to the closing of the throttle-valve that would be unnecessary.

1108. Is there any other mode by which it strikes you, that you could indicate upon the deck what was doing in the engine room?—The velocity of the engine itself, the number of revolutions of the wheel.

1109. What is your opinion as to whether it would do to have this, which you describe as an index, not only an index but a lever, that the master of the vessel might use himself?—There can be very few cases in which it would be necessary for him to interfere; I do not know of one in which I should recommend it being taken out of the hand of the only person who can manage it.

1110. Are you aware that such levers have been used?—They have been in some parts of England, but particularly in Scotland on the lakes; they work the engine from the decks, and they do that in some of the Liverpool vessels, but then it is the engineer who always does it.

1111. Do you consider that a good plan?—I do not see any objections to it at all.

1112. What are the advantages arising from it?—Merely that in confined navigations they can hear the pilot better than when they are down below.

1113. You do not see any objection to it as to the management of the steam?—None in small vessels; but if the depth of hold is great, and the distance from the deck to the valve which is to be worked is considerable, of course the action will not be so rapid as by a man who is down on the spot close to his engine.

1114. Then you think this would be a very easy thing on board a small vessel, but not on one of a larger size?—I should think not, the engine would not answer so readily.

1115. Do you know what effect the engineer acting upon the deck would have upon the engine?—The only difference is that the man has got the long arm of the lever, his arm has to travel a greater space to produce the same effect.

1116. You are closer to the engine?—Where vessels have a considerable depth of hold then they are at a considerable distance from them.

1117. According to the present plan the captain is upon the paddle-box to guide, and he gives his orders to the engineer to turn; is it not necessary that the man actually steering, in order to avoid an object, should know what speed the vessel is going at the moment?—Yes.

1118. Therefore the whole three being upon deck is an advantage?—In smaller vessels I should think it is; but I could very well conceive that circumstances might arise in larger vessels which might interfere with that.

1119. Will you have the goodness to describe to the Committee what this invention of yours is, and what effect in your experience it has had upon the swell?—It would appear rather invidious under the circumstances of the case, and if the Committee will excuse me, I would prefer not answering the question.

1120. Will you have the goodness to state to the Committee anything that has struck you in your great experience of steam-boats as a proper precaution in steam-boats navigating, for the safety of the vessels themselves; has anything ever struck you as being wise to adopt?—It has struck me that it would be advisable that the same kind of precautions that are taken to point out to mercantile men who have to lade their goods, the difference that there is between the manner in which one vessel is formed and the other, in order that they may make that selection which pleases them best. Mercantile vessels are constantly surveyed and classified, and in the notes which the ship brokers and agents circulate they mention the class of the vessel. It serves also for the underwriter to regulate his expense of insurance, and each one knows what he has to incur; some prefer a lesser freight, and some a larger freight. I would cause every steam vessel to be surveyed, and according as they are efficiently or inefficiently built they should have a certificate of their class, and that certificate of their class should be made as notorious as the circular to the shipper.

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1121. Who would you make the judge of that class of ship?—I should imagine, that as persons who are acquainted with ship-building survey vessels, so those who have to do with the hull of the steam vessels should survey them.

1122. Would you confine your observation to the hull of steam vessels?—Yes; I am afraid of touching machinery, for fear of fettering talent, which is within the comprehension of a very limited number of persons.

1123. Then the observation which you have made alludes merely to the hull of the vessel?—Yes; although it would be very desirable to obtain commissions to survey vessels also.

1124. Do you apprehend that the hulls of vessels are built with carelessness in those that go to sea, and are very often old?—Some are built uncommonly well, and some very loosely.

1125. Do you apprehend that any of them are built with carelessness?—I should be loth to deliver an opinion, because I have not had sufficient experience. I have known vessels built so very slightly, that it is not at all unlikely they should have been lost.

1126. Who surveys the sailing vessels?—There are persons, I believe, appointed at the Trinity-house.

1127. Do you know of any complaints that have been made with regard to that system?—I have never heard of any complaint. I believe Lloyd's Coffee-house has the power of surveying vessels also.

1128. Do you think, with regard to steam vessels, that a commission might be appointed of six commissioners, two engineers, two ship-builders, and two ship-masters. Would that be sufficient for the purpose?—The knowledge of ship-building is so general, that men cannot differ upon the fitness of a vessel, if they are at all proficient in the art, but in steam vessels there are no two men who agree.

1129. By a complication of engineers?—With respect to engineers alone there are few of them who know anything about ships, and therefore if such a commission was adopted, it ought to be a mixed one.

1130. Can you speak of any accidents happening to vessels arising from the slowness of the board?—No, I cannot. It has not excited surprise in me that many of those steamers, or some of them, have been lost, having had an opportunity of seeing them building, but whether it has been the identical ones which excited my observation, I cannot tell.

1131. Have you built any steam vessel in England yourself?—None.

1132. Are you aware whether it is the practice, before a vessel can obtain a certificate, to be surveyed?—I do not know; I should imagine not, from the carcasses I have occasionally seen.

1133. Have you any objection to inform the Committee whether there is any vessel so fitted as you propose?—Not in this country, except the *Confiance*.

1134. Are there any in the Mediterranean?—Yes, three.

1135. All in the Adriatic?—Yes.

1136. Have you any objection to state to the Committee whether the machinery so fitted often requires repair?—I have had one set at work from July 1829, without repair. I should say it requires less repair than any other system.

1137. What is the nature of this improvement?—It is an eccentric paddle-wheel, to economize that power which is wasted by the common wheel.

1138. Is the *Confiance* in the river at present?—She is at Woolwich.

1139. This invention prevents swell, does it not?—Yes.

1140. Does it accelerate or diminish the motion?—It accelerates the speed of the vessel.

1141. Do you know a Mr. Orlando Harris Williams?—I do not.

1142. You do not know that he has invented something of the kind to which you have been alluding?—No, I was not at all aware of that.

1143. Is your knowledge of steam-vessel building, with respect to vessels navigating rivers, or sea-going vessels?—More of sea-going vessels than of river-going.

1144. You said you had been quite surprised that some of those vessels had stood the sea, from the construction of their hulls?—It is by the mode in which the timbers have been laid; I am no advocate for overloading steam vessels with timber.

1145. Is it not the case that steam vessels are often overloaded with timber?—I have seen some vessels much more heavily timbered than even stronger vessels.

1146. Would

1146. Would it make any alteration as to their speed, whether a steam vessel is built equally stout with a sailing vessel or not?—I should say that it would, because to do that in general, where a vessel is calculated to carry passengers or very light weights, obliging them to be timbered like vessels that carry very heavy weights, you throw out of calculation very likely the position of the wheels, and other things which operate upon their velocity.

1147. Do you think that with proper attention the vessel might be increased without rendering her more cumbersome?—Yes.

1148. Do you know of any vessels that have been fitted up for other vessels, and used for steam vessels?—With some alterations.

1149. Have you known any large West Indian vessels used in that way?—No, their form would of course preclude them.

Mr. John Lane Higgins, called in; and Examined.

1150. YOU have invented a mode of lighting vessels in various directions?—Mr. J. L. Higgins.
Yes.

1151. Is that a model [*the same being shown to the Witness*]?—That is a model.

1152. Will you be good enough to describe to the Committee the use of it?—This represents the chimney of the steam vessel; these are two ordinary lanterns, but of a different colour from a common lantern, in order that being seen they may not be mistaken for Trinity-house lights or any other lights, but they are ordinary lights of a different colour. This is a centre-light revolving between the two fixed ones. When one vessel is meeting another, this light is seen revolving within the orbit of these two. When one vessel is altering its course, giving way to another, or rather when two vessels are within view of each other but not coming towards each other, then this revolving obscures this light in the middle but leaves it open at the sides, so that each vessel knows whether another vessel is approaching towards her or receding from her. That is the whole of its application.

1153. It is set in motion by the steam?—It derives its motion from the steam engine. That was the extent of my object two or three years ago. Since this question has been before the Committee it occurred to me that the same apparatus might be made to indicate the rate at which the vessel was going. If this lantern without a light by day was made to revolve at equal times with the paddle-wheels, the harbour master or any person can tell when he looks at it at what rate it is going at any time when any accident takes place: "That vessel is going too fast, I know by the revolutions which the lantern indicates."

1154. Do you imagine in practice it would be possible for the lantern to revolve so fast as the paddle-wheel?—Yes, of course, with a less centre, but it may go the same rate.

1155. You could make a perfect calculation by that, which would be seen by any person either on the shore or in the river Thames, and by which he would know the rate at which the boat was going?—Yes, to see it revolve; I think it would tend to lessen very much the danger of vessels, to enable a vessel to see the steam-boat; sometimes at dark or dusk the captain calls a boat alongside, and the boatman cannot tell whether the wheel is stopped or partially stopped, but by looking up he would know at what rate it was going. The front light is not obscured when any person is in danger.

1156. If you get one of the lights obscured, you know that the vessel is not coming towards you?—Yes.

1157. When the vessel is upon you, you have no mark behind the light to catch it?—Long before I can be so near the opposite vessel as to be in danger, I am sufficiently near to know whether it is revolving fast or slow.

1158. Would you observe the revolution at all?—If it were desirous to produce such an effect, unquestionably, by making it revolve in a smaller orbit, that effect would be produced; but my object has been to obviate that.

1159. Have you put it into practice at all?—No, I have not. I beg to state that I showed it to the body of the Elder Brethren of the Trinity-house; there was a large muster, the Chairman expressed his approbation of it, and expressed his regret that they had not the power to enforce its adoption. I showed it to one of the harbour masters, who liked it, and thought it would be a good thing, and said

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that he would confer with the captains of steam vessels; and afterwards he told me that he had conferred with one, who said that if it were enforced upon all, he would agree to it.

1160. Did you offer it to the captain?—No, I did not.

1161. With respect to this light showing the rate of speed at which a vessel is going, is it not a principle of optics, that when a lantern is revolving round a centre with any degree of motion, the light will appear in a circle all round?—It was no part of my object, when I made this light to enable vessels to distinguish the course which others were going, to know whether the vessel was going fast or slow, so long as I know that I am going ahead or astern of another vessel; and that which may appear to be an absurdity, with respect to ascertaining the speed at which a vessel is going, is only part of a very rational theory; for the lantern appears as a great light, and as we approach one another that will appear more clearly, and it will be evidently a revolving light when you come sufficiently near the vessel to be in danger. And as to it being an indicator of the speed at which vessels are going, no absurdity ever can attach to this, because, supposing the revolving light to appear as one round light, then it will give a stationary light instead of a revolving one.

1162. Will you state to the Committee, what is the advantage of the revolution of the centre light, as an index of the course of the vessel, over three lights placed stationary in a line, but with the centre light placed beyond the other two?—Because in that case you never would know when the vessel was stationary. I might meet a vessel at night, with all the three lights stationary, and I never should know when it had stopped, nor would that know when I had stopped; but if each of those had revolving lights, if it is the duty of the vessel to get out of my way, when I stopped then it would proceed.

1163. Then it is merely as an index whether a vessel has stopped or not, that you consider this an advantage?—Yes.

1164. Would not that be equally obtained by having the three lights stationary?—Suppose you were crossing my course with stationary lights, I should not know whether you were proceeding so as to be likely to go ahead of me, nor would you know whether I was likely to go ahead of you, but if you find my lights stationary you are sure that I am lying by, and then you proceed.

1165. Then it is as an index of motion that you recommend it?—Yes.

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COLONEL SIBTHORP IN THE CHAIR.

Mr. Charles Christie, called in; and Examined.

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1166. WHAT are you?—I am one of the fellowship porters, but by the way, I am a waterman as well.

1167. Your business is to be very often afloat on the river?—Nearly every day.

1168. Have you observed the effect of the passage of steam vessels?—Yes; their progress has been very great; so much to agitate the water, that boats at all times are not quite safe. In the case which I am going to name, one of our boats was sunk, although I am not the eye-witness to it.

1169. What have you seen yourself?—I have been in the habit of seeing the motions of steam-boats ever since they were introduced into the London river; and the march of improvements has made such strides, that from introducing vessels of 16-horse power they have now introduced them of 200-horse power.

1170. What is the effect of that?—The effect of that is, that of course the power propelling causes that agitation which they had not the power of doing formerly, because all the power they could put on a steam-boat formerly could do no hurt whatever, because I could row a wherry as fast as all the power they could put upon the steam-boat; I could race a steam-boat then.

1171. Do you mean to say that steam-boats go faster than formerly?—Certainly; from 16-horse power to 200.

1172. What

1172. What is the effect upon the small craft?—The effect is, that their running with great velocity through the water causes that agitation which many times makes it dangerous to boats that have such number of passengers as the Act of Parliament allows.

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1173. And accidents occur?—And accidents occur.

1174. If the passage of those vessels through the water was limited to a less speed than they now go, would it correct the evil?—Certainly it would; I am decidedly of that opinion, because a vessel going five knots through the water will not froth at the bow, especially sharp-bowed vessels, as they are now constructed; most of the vessels that have been built within these five or six years past, they have cut the heads of them, and they are now so sharp that a vessel going five knots through the water would make no swell.

1175. From what part of the river to London Bridge would you extend that limitation?—From London Bridge after you get to the Horse-ferry, and clear what we call the Lower Pool.

1176. To Limehouse?—To Limehouse.

1177. Would that be sufficient?—That would be sufficient; but I think they might be allowed a larger degree of speed, though not the full speed, beyond that.

1178. You think it would be necessary to limit them?—Yes; the City have issued orders to that effect.

1179. Would those orders issued by the City have enabled them to obviate the evil, if the law had enabled them to carry it into effect?—Not the least doubt of it.

Captain *Thomas Richbell*, called in; and Examined.

1180. YOU are at the head of the Thames Police-office?—I am senior magistrate there, and I have been for fifteen years nearly; and I was captain in the navy.

Capt. *T. Richbell*.

1181. You are aware that this Committee is formed for the purpose of inquiry into steam navigation in general, and at present they are engaged more particularly with the navigation of the Pool; can you give the Committee any information upon that subject?—We have had, as magistrates of the Thames police, frequent complaints, weekly, I may say almost daily.

1182. Of what nature?—Of the rapidity of the steam vessels that go up and down the river.

1183. Of the effects produced by it?—Of the effects produced by it.

1184. What are those effects?—They cause such a swell that the small boats are in the most imminent danger. I have never seen a boat upset myself, but we have often heard of it.

1185. Your office is near the river?—Yes; the water comes up to the house. I never saw one upset; there was one, they called to me that two men had jumped overboard, and I saw them in the water.

1186. But still you have almost daily complaints?—Daily complaints. There was a complaint about a month or two ago of a master-lighterman, that his boat was upset, and his son and he were both under the wheel of the steam vessel, and it was the greatest chance that they escaped.

1187. Did you investigate that subject?—We did not; they brought that complaint and another matter; that he had a high ton lug-boat, a large boat with only seven ton of iron in her, and that two of the steam-boats, I think he said, passed and caused such a swell that the man was obliged to throw his oars in, and throw himself down to the bottom of the boat.

1188. Then you did not investigate that?—We did not; it did not appear that there was any damage in consequence.

1189. Do you know of some accident connected with the City of London steam-boat a short time since?—Yes; the case was brought before me.

1190. Will you state to the Committee what happened?—A lighterman, a barge-man in short, got a summons against the master of the City of London, charging him with running aboard the barge; however, it appeared upon investigation, I believe, clearly to myself and everybody else, that the barge actually run aboard of the City of London; and this was the report (I did not see the place), that she was stove about two feet in; they were obliged to send her passengers on the other side, to prevent the water running into the vessel.

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1191. They both met with damage?—The barge blocks that they heave her mast up by; she was a vessel about 70 tons; the hook of that gave way, and the mast came right upon deck upon the people.

1192. From the investigation of the subject that took place before you, you came to the conclusion that the people on board the barge were most to blame?—It appeared so.

1193. Do those numerous complaints that come before you relate not merely to the ship, but to particular facts that occur?—Yes, we have a great number of facts.

1194. What in general is the nature of the injury that occurs?—They arise entirely from the rapidity of the steam vessels.

1195. What is the injury?—The injury along shore is, that the watermen get the boats stove; the steam-boats knock such a swell up, like the surf upon a beach; I have seen our boats almost filled, and the boats knocked against the others.

1196. When you say your boats, you mean the boats belonging to your office?—Yes; they are much larger than the other boats. The Royal George about three months ago created such a swell, that the gunwale of one boat got to the other side, and hung her up, as the river term is, they stove her up for a foot at least. I mentioned the circumstance to Mr. Phillipps, the Under Secretary of State, and he said, send them the bill; and I said it would be 30s. or 2*l.*; we sent the bill, and they paid the bill.

1197. Do these remarks apply to injuries sustained by vessels at their moorings, or at the shore where they lie?—Principally at the shore; the shore is so washed now, in consequence of the swell that the steam-boats knock up, that they can walk along shore in consequence of the wash, it has taken all the mud away.

1198. Has it rendered it less comfortable for the boats?—It certainly injures the boats considerably.

1199. It narrows the sides of the river; it shows the shore?—Yes, it takes the mud off from the shore and leaves the hard ground, and the consequence is that it hurts the boats much more.

1200. Then it widens the river?—It does not widen the bed of the river, it is only between high water and low water.

1201. You mean to state to the Committee, that the mud is washed off, and leaves the gravel there?—Yes.

1202. And consequently it was sharper gravel for the boats to lie upon, and injures the boats?—Yes.

1203. Do you find any difference in the depth of the water?—No, I think not.

1204. As a magistrate, as the law at present stands, have you been able to apply any remedy to those complaints?—The notice is so short to me, that I have not had time to examine the books, but I think there have been five or six convictions taken place, in consequence of the mischief done by steam-boats from their rapid rate.

1205. Under what Act of Parliament have those convictions taken place?—Under the bye-laws of the Waterman's Company; five miles an hour is what the bye-laws state.

1206. Those bye-laws are made by the court of aldermen under the direction of the Act of Parliament?—Yes, and they are approved of by one of the Judges, "That no steam-boat or vessel shall navigate upon the said river between the eastern limits of Limehouse Reach, at a greater rate or speed than at the rate or speed of five miles or knots an hour; and if the owner, master, pilot or other person having the command of such steam-boat or vessel, shall navigate the same within the last-mentioned limits at any greater rate or speed than aforesaid, he shall forfeit and pay for any such offence not exceeding 5*l.*" This only relates to men that belong to the Waterman's Company, and unless he is a freeman of the Waterman's Company, you have no power over him by this bye-law.

1207. That is the opinion that is formed upon that bye-law?—That is the opinion, we cannot act contrary to the Act of Parliament.

1208. Where the persons complained of were not free of the Waterman's Company, you could not fine them?—We have no means, and you cannot.

1209. Is there not a regulation, that no person shall apply for hire within certain limits, unless he is one of the Waterman's Company?—That does not relate to steam-boats.

1210. From your observation, do you think that if that regulation was complied with

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with by all the steam vessels, that the injuries complained of would be in fact done away, or very materially lessened?—I conceive that there would be no sort of danger if that regulation was complied with, of going five miles in the room of going 10 miles; I have certainly known them going at nine or 10; I have seen six steam-boats go by together.

1211. You of course can form a pretty good judgment of the rate or force of the tide on particular occasions; if this rule were strictly enforced, would the vessels on all occasions come over the ebb-tide, if you restrained them?—Possibly upon a strong ebb-tide, if they were to make an allowance of a knot and a half more; but the tide does not, in my opinion, go above three miles an hour at any time.

1212. Are you very positive, and have you had sufficient experience to be enabled to speak with any positiveness as to that?—I might be under the mark in some particular parts of the river.

1213. The question refers now from London Bridge to the Lower Pool?—Possibly it might go three and a half, but never more.

1214. You think it never reaches four in the strongest springs?—I do not think it does; it might possibly when the flood is out; the great rapidity of water coming down might cause a little more than three miles and a half, if ever it exceed that.

1215. Therefore, if this law was considered effective under all circumstances that you recollect, if she were going five miles, she would be going four miles and a half with the tide?—Certainly.

1216. Do you conceive that with that mile and a half over the tide, on turning any point, or on the wind catching her bow, she would be enabled to turn sufficiently quickly to prevent her sheering to the other side of the river?—I think, going five knots through the water, I do not think her resistance is any greater than if she were going at the flood; it does not appear to me to be so.

1217. When she is going with the flood-tide the tide assists her round the points, whereas when she is going against the tide the tide strikes the lower part of her bow and would be very likely to sheer her round?—There is certainly more difficulty in a point where the tide is setting sharp round it.

1218. But you conceive that she would be able to meet that?—Yes, that is my opinion; I have been 29 years on the river constantly employed.

1219. Therefore, if the Act of Parliament restricted them to five miles an hour, you conceive there would be no difficulty of that kind?—No.

1220. She would be enabled to get up to her moorings?—Yes.

1221. If any injury be done by a steam vessel to a sailing vessel, does there exist a court in London by which compensation can be given?—None but the police offices.

1222. You have no summary power?—We have if the boats are navigated by a waterman.

1223. But otherwise there is no summary power?—No.

1224. Distinguishing between recompense for damage done and the penal power that the police offices have, every injury that is done ought to be subject to two penalties: the one a penal one, as a penalty levied by the King, or for any other purpose; the other, the actual compensation for the damage done to the vessel. Have you the power of considering those parts of the penalty for damage?—I have some doubt about that.

1225. Your power applies merely to the infliction of the penalty?—Yes.

1226. And that is confined to their being members of the waterman's company?—Just so.

1227. Have you the power of giving damages?—I have a great deal of doubt about that: I rather think not.

1228. Do you conceive, if there were power given to any court of giving speedy redress in compensation for damages, that that would not be a strong inducement to captains of steam vessels to take greater care how they might proceed up and down the river?—There can be no doubt of it, that if a law of that kind were passed it would be of the greatest advantage.

1229. Do you not think that the knowledge that there were such a power of enforcing the immediate payment of compensation for damages, would of itself be a sufficient check to any carelessness on the part of the captain?—In a great degree; there is a great deal of mischief done that they never make any recompense

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for; poor watermen have their boats stoved, and they come to us, and we say, we can do nothing for you.

1230. You distinguish between compensation for damage and penalty?—I cannot understand that; there must be a conviction before you can levy a penalty or damage.

1231. Admitting that a man might go 20 knots an hour, if he could do so without inflicting injury, but if in going 10 miles an hour they inflicted injury, should he not be subjected to a penalty?—It would be very desirable; there is no doubt they would keep a better look out, and less damage would occur.

1232. Do you think that would be sufficient check?—It would be a check to a great extent; but some are so careless that they do not care what they do.

1233. May not that arise from the means of compensation for damages being so tardy and expensive that people will not have recourse to them?—That is just the case.

1234. You stated that you had yourself seen as many as six or seven steam vessels together?—I reckoned six to go by my drawing-room window (I live at the police office) in six minutes, four up and six down.

1235. At what speed do you suppose at that time they were going?—I should suppose at not less than from seven to eight miles an hour, seldom if ever they go less.

1236. Through the water?—Yes.

1237. Then that would be ten?—Yes; I have frequently seen them go ten.

1238. Have you carefully examined the difference of swell which vessels make at different speeds?—Only from observation. I have seen them go through the water; when they go through slowly, they make very little swell; and when they go through with any degree of rapidity, they make a great deal; and a good deal also depends upon the construction of the vessel.

1239. Have you observed that the larger class of vessels, practically, do much less injury than the smaller vessels that ply between Margate and London?—There is a great number of vessels upon the river now; I have a list here of near 70 vessels upon the river.

1240. Do you, practically, find that the larger class of vessels, those that ply to Rotterdam and Edinburgh, do less injury than the smaller ones?—They certainly do less injury; they are more careful; they have not that inducement, which the smaller class of vessels have, of going quick.

1241. How far do you consider this Act to extend?—From Yantlet Creek to Windsor.

1242. If it does so, it certainly includes the Gravesend steam-boats?—Certainly it includes the Gravesend steam-boats.

1243. Therefore if any Gravesend steam-boat went more than five knots an hour, you have the power of punishing them?—We have.

1244. Therefore at present the only remedy that is sought is with respect to those steam-boats that go down the river to Margate?—Only those that go down the river.

1245. The only power that you require in your hands to enforce the regulation of the Lord Mayor relates to the steam-boats that navigate from London down beyond the Thames; all others you have a power over by this Act?—I think not; it does not strike me so.

1246. How then do you get clear of this clause: "And be it further enacted, that if any person, not being a freeman of this Company, or an apprentice to a freeman of this Company, or to a widow of a freeman of the said Company, shall at any time act as a waterman, or ply, or cause to be worked or navigated any lighter or other craft upon the said river, from or to any place or places, ship or vessel, within the limits of this Act, for hire or gain, every such person shall forfeit and pay for such offence a sum not exceeding 10*l*."?—We have had a number of convictions of that kind, but they do not relate to steam-boats; they mean by "craft," lighters, and so on.

1247. How do you explain this Act with reference to steam-boats navigating between London and Gravesend?—We do not consider that part relates to it at all; it only relates to men who work upon the river for hire or gain, that are not freemen of the Waterman's Company, "any boat, barge or craft."

1248. Suppose a man was brought before you for navigating a steam-boat between Gravesend and London, plying for hire and carrying passengers in a steam-boat,
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without belonging to the Waterman's Company, would you not consider that you were bound to fine him 5*l.*?—I think not.

1249. Will you be so good as to read the article?—I will. We never have yet; there have been several cases brought before us of that description, and we have been obliged to discharge them, not considering them to come under the Act.

1250. Have you had your attention turned to that Act?—We have had frequently, and we never considered that it related to anybody but the Waterman's Company.

1251. Do you not see, in reading that bye-law, that it relates only to those who are not of the Waterman's Company?—It only relates to persons using lighters and small boats or craft in the said river.

1252. Are the sailing craft that ply between Gravesend and London supposed to come under that clause?—There have been a number of disputes as to what is a craft; we have had a number of arguments upon that word by counsel even.

1253. You never took any law opinion upon the subject?—No; we have had counsel.

1254. Did you ever ask the Home Secretary to get the opinion of the law officers of the Crown upon this?—I do not believe that ever we did.

Mr. John Meriscoe Pearce called in; and Examined.

1255. ARE you the Solicitor of the Gravesend Company?—Yes.

1256. You heard the Committee read this clause about watermen?—I did.

1257. Do you consider that clause to relate to all steam-boats that ply within the jurisdiction of the City on the river, that is to say, between Windsor and Yantlet Creek?—I always considered it so; and I speak from recollection, that some time ago a question was discussed before the Lord Mayor, when the Gravesend steam-boats were charging at a higher rate than the others, and they were obliged to reduce them to the fares of the others, considering that they were just like the others plying.

1258. If they ply beyond Yantlet Creek, they get out of the jurisdiction?—Yes; the distinction is, that boats in the jurisdiction are registered in the name of the watermen; those that go to Margate, and so on, are not.

1259. If the Margate boats were to take up passengers, would they not render themselves subject?—And therefore they never do.

1260. How is that with the Sheerness boats, for they take passengers?—I do not know; they probably may be likewise registered as watermen, for anything I know; I know that the Margate boats are not, and that they do not take up passengers for that reason.

1261. That is considered plying for hire?—I should so understand it.

1262. Are you aware of any case in which it is determined to bring the Gravesend boats under the regulation of this clause?—No, I am not; I am not generally concerned for the Gravesend Company, only on this occasion.

1263. What company are you concerned for?—For the General Steam Navigation.

1264. Then all your boats you consider to be exempt from that?—Yes.

1265. They go to Calais and Rotterdam?—Yes, and to Margate and Ramsgate.

1266. In point of fact, you do not allow them to take up passengers?—I have understood from the directors, that they do not take up and set down to Gravesend; they do not hold themselves out as taking passengers to Gravesend; one may easily conceive that they would, if a passenger was ill, put him down.

1267. Are you aware at all, of your own knowledge, that it has been urged before the magistrates that steam-boats were not liable to that law?—No, I was quite surprised when I heard Captain Richbell say what he did. I beg to be understood as speaking only from general observation, and hearing the clause read; I always understood it a settled point.

1268. A very large proportion of steam vessels working in the river are exempt?—Yes.

1269. Is there any law at present by which damages can be remedied except at the common law?—No, except at the common law, for wanton damage.

1270. Supposing that any man was to conceive his barge would be of more use if worked by steam, than it was at present, for the purpose of carrying corn and other materials, what would be your opinion then of those lighters, say nothing of

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passengers?—I fancy that would be within that Act; but I should like to look at that Act more attentively to give an answer.

1271. The altering the form of the vessel would not alter its position with regard to the law?—No; I believe it has been distinctly decided that steam-boats plying on the river are subject to the restrictions like other craft.

1272. So that the being moved by steam would make no difference?—Not the slightest.

Mr. *Ralph Watson*, called in; and Examined.

Mr. *Ralph Watson*.

1273. ARE you in any profession?—No, I am not; at least I hold a situation under His Majesty's Government.

1274. What situation do you hold?—In the Victualling Office. An accidental circumstance drew my attention to this subject, which I will take the liberty of stating to the Committee, and the invention would, I conceive, have preserved very many lives which perished at the loss of the *Rothsay Castle*; the plan is simply appending tubes in different parts of the vessels, more particularly between the timbers.

1275. Does your invention apply to steam-boats only?—Certainly not; but it would have been the means of saving a great many lives.

1276. Does your invention apply to the saving of the vessel, or to the saving of lives?—To the saving of the vessel, by which many lives would be saved.

1277. Will you be good enough to state to the Committee your suggestions?—It is a plan for preventing ships foundering at sea, by means of the application of tubes: those tubes placed between the beams, and in the rafts, and in every other convenient part of the vessel, to such extent as shall counteract the effect of that small quantity of additional weight, or excess of specific gravity, that carries the vessel down. There is a small quantity to support, so much of it is supported by the displacement of water.

Arthur H. Holdsworth, Esq., a Member of the Committee, made the following Statement:

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I THINK the best way of looking at this subject would be, by first taking that part which regards the Thames; and in turning my mind to it, as much as I have been enabled to do, it does not appear to me, from anything that I have seen, that any damage can really be done by a steam-boat more than by another vessel; and from their construction, and their facility of working, probably less ought to be done than by another vessel, except in that peculiar circumstance attending them which does not attend other vessels, the wave that is left in consequence of their rapid progress through the water. This circumstance has long since excited my attention; and there appears, as far as I can judge, to be a something, at the knowledge of which science has not arrived, because, from my own observation, various vessels not only produce various quantities of rise in the fluid through which they pass, but I have observed that it comes from various parts of the vessel, and, therefore, there is within it something which science has yet to discover. Of course until that discovery could be made and the system then be altered, we have reason to fear that the evil would still exist. I have exemplified this more in my own harbour than in the Thames, because it is a larger harbour and there are fewer vessels, and I have had a better opportunity of watching it. There were two vessels in the year before last, I think, that used to ply from Plymouth to Portsmouth; one was the *Sophia Jane*, and the other was the *Brunswick*. Of the two, the *Brunswick* appeared to be the larger vessel, and I had reason to think, a vessel of much more beam and that she drew more water. The principal disturbance in the water left by the *Brunswick* was after she had passed through, and was more behind her or in her wake. The *Sophia Jane* created a wave off each bow, at an angle perhaps of 30 or 35 degrees, and she certainly, as far as my observation went, threw it from off the bow, so that her appearance was, as she passed through the water, as if she had a pair of whiskers. In consequence of this circumstance, I found out who the gentleman was in London that owned the vessel, in the hopes of getting at her build at first, and then to endeavour, from my own reasoning and the reasoning of those who had more experience than myself, to ascertain how this arose, not so much for the safety of other things as to ascertain the cause in the vessel itself, as it

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it is evident that there must have been something peculiar in her construction to enable her particular bow to produce that effect, which the other steam-boat did not produce. I found out, at last, the gentleman who owned her, and called upon him, but he could give no account or any description of the shape of the bow, or any reason why that bow produced that effect.

1278. You did not get the plan of the bow?—I did not. I found from him that the vessel had been sold and gone to the South Seas. She was a very light and a very speedy vessel; she appeared to draw but very little water. With regard to the peculiarity of her build, she was not built in the usual way, but built with double planks instead of timbers; that would make no difference in the swell of the water. I was particularly struck with the evidence that has been given, that the lighter vessels and the smaller vessels keep up a greater disturbance than the larger vessels; therefore, it may not be that those larger vessels do not go at the same rate, but their form may not produce the same effect. Being the other day in the dock-yard at Woolwich, two steam-boats passed, and I drew the attention of an officer of the navy to them, to see from what part the waves that came from them appeared to proceed, and they proceeded from different parts of the vessels; one seemed to throw off the wave from the paddle-box, and the other between the paddle-box and the bow.

1279. Were those two vessels going near one another?—No, there was an interval of a quarter of an hour between them. The reason why I was anxious to state this to the Committee, was, that it does appear to me, whatever view the Committee may take themselves upon it, that the thing is so uncertain as to its cause, that until that can be defined, it may be necessary to legislate for it as an evil that cannot be avoided. That was the impression I wished to give the Committee upon it; and I think the remarks which I have made will be borne out considerably by a part of Captain Martin's evidence, to whom I put certain questions, that I might see whether my own views had at all struck him on board his vessel. With regard to the boats, there is only a single fact, which perhaps is more curious than of any other value. Questions having been put by the Committee as to boats which navigate the Thames, whether they were built of the same class as formerly, upon which the wave caused by the steam-boat produces such effect, I can state, that I possess two drawings, by William Vandervelde, which must be somewhere about the year 1690 to 1700, and each has various boats in them; but one is a procession on the Thames, and there every boat that is rowed is completely of the same description as the boats now in use, with this difference, that judging by the size of the figures, they are about a foot out of water, and therefore a heavier boat, and moving more slowly. With regard to the accidents that occur by steam vessels, I need not say that the wave thrown off by them is of the worst description, because it comes almost upright, so that the boat has no time to lift to it, and the moment she does she is thrown completely up, and is then plunged into the next wave; it comes like the sea with a strong tide and wind meeting. I fear that the greater body of evidence which has been given with regard to the great height of the wave is not exaggerated, from my own observation; because at Woolwich, where the river is not particularly narrow, off the dock-yard, when the steam vessels were passing, quite on the Essex side, they produced so heavy a sea that a ship's boat, appearing to be a jolly-boat, lying alongside a raft of timber, would, I thought, from the way in which she was raised, be thrown upon the timber itself. It was no ordinary sea that did that. The vessels were laden very full with passengers, and therefore I presume they were Margate boats.

1280. What is your opinion with respect to forms of Steam vessels; would not certain forms in science be more likely to produce certain effects?—Yes; but it would require a number of experiments, being a thing perfectly new, to ascertain that particular point, and one particular form might not be suited to other purposes for which the boat was intended.

1281. If science had ever discovered the causes of the different variations of undulation, would you be inclined to legislate upon that subject?—No; because I am afraid that you would then try to legislate upon that which you would not have the means of doing. With regard also to the steering, the suggestion made by Captain Hall I was before aware of, and I should certainly give it as my opinion that the steering forward must of necessity, where you have to avoid small boats, be particularly valuable, in order that the helmsman should be able to see any small object under his bows when he is coming up the river.

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I would also suggest another thing, which does not appear to me to be applied to steamers: suppose the man at the helm wishes to give an order to the engineer who is in his engine-room, with many persons on deck, and with the wind blowing fresh, the attention of the captain may be drawn away by some other circumstance at the very time when it is most necessary for him to attend, and the engineer may fail to get that direction which is most necessary for the vessel and for the passengers: I would therefore suggest a speaking-pipe, leading from the man at the helm to the man in the engine-house, and the thing is effected without any difficulty. That is a thing which is used in houses; I therefore conceive that it may be applied to a steam-boat. With regard to the safety of vessels at sea, there are two points which I suggested to the Board of Admiralty a great many years ago, at least ten, and they are, to my mind, matters of considerable importance; the one is safety from fire, and the other is safety from sinking, each of which are matters in which persons at sea would find great comfort. I do not understand that any of the steam-boats, or if any of them, certainly not the generality of them, have at all availed themselves of the use of their own machinery for the working of such pumps as could at once keep the vessel free under any ordinary circumstance of any leak, or any considerable quantity of water that might arise; because it is perfectly clear to persons who are acquainted with the machinery of pumps, the difficulty of pumping depends on the lift. The height the water is to be raised must be so small, that a very small power would create a safety which is of the greatest consequence to a vessel at sea, and I was particularly struck with that of the *Rothsay Castle*, because those who are accustomed to vessels of that sort will know, that suppose you spring a leak, and that leak gains upon you at sea, one of the first operations will be to wet that portion of coals, the moment it comes to a certain height, which is nearest for use. In the proportion of the accumulation of water amongst the coals will the power of raising your steam be diminished, and of course the difficulties of escape increased; whilst, if there were pumps of sufficient strength for that very small lift attached to the engine, which an engineer would put in such a way as would be most conveniently suited for this purpose, I can foresee no common circumstance of leakage that would not with the greatest ease be overcome. Then with regard to fire, the same thing is directly applicable. I have an engine myself, of only 30 inch cylinder, with a common force-pump and air-vessel; it never takes the slightest power from it of any imaginable consequence, and it will throw through a nozzle of an inch five hogsheads and a half per minute. What drew my attention to this, was a dreadful fire which took place some time since, where it was the greatest chance that the vessel got to shore. Now had an engine on board been brought to bear upon the fire, it would have been easily put out. There is another point which I think also is worthy of attention, and that is this, the steam power which the vessels themselves have; for instance, I have reason to believe that the power which is usually given to those vessels is that which shall be sufficient for general purposes, and that it is seldom enough for any extraordinary purpose. A friend of mine was, the other day, in a very large steam-boat, it is not necessary for me to mention the name; she met an ordinary gale of wind; I say ordinary, because it is a month ago. The steam packets bound to Margate were afraid to touch the flats, from the great sea there was from the north-east; they went round to Ramsgate; yet I know that the vessel to which I allude could not keep steerage way, she was obliged to bear up and to seek shelter. Then had that shelter not been found, what would have been that vessel's situation? I shall be asked, what would be the remedy. The remedy has appeared to me the simplest thing in the world, that there should be the means of obtaining extra power. It has been said by engineers, if you give them extra power, they will never be content without using it in ordinary times; but that I conceive to be a very foolish proposition, because it is not at all necessary that they should use the whole of the power which they have, if the power granted to them is more than is necessary for the fair and proper speed of the vessel. I believe that there is a limit to the speed of a steam vessel, as there is to the speed of other ships. We know that there is an accepted speed under which ships range. There can be no difficulty, in my mind, in using engines of such power as shall carry that vessel at what is the average speed of the best vessel, and when opposed by another element, namely, the wind, and the sea raised by that wind, that there should be power enough to meet this new obstacle or difficulty as it arises.

With

With that view high-pressure engines have been conceived; I believe, from all that I have been able to collect, in America in many instances they have succeeded. I have reason to fear that it will be found that the high-pressure engines here will not succeed; and my reason for expressing that fear is, that they will require an extra quantity of coals, which in many instances amounts to a prohibition, because in fact the ship would not have the means of carrying what would be required. If it be found that that is the fact, and you can work the present boilers with greater facility, raising a greater quantity of steam with less quantity of coals than you can with the high-pressure boilers, then you have only to apportion your boilers and your engines, so as to have the means of giving a greater quantity of power than is ordinarily required, and you accomplish your object. It will be stated to me directly, "Well, but if we give them this power we know that they will use it." I say they cannot use it if the captain is an honest man. It would be just as bad an argument, that a coachman would always use six horses, because you allowed them in the ascent of a hill. Now let us see whether a remedy cannot be found. I would grant that the engines would be rather more expensive, because they would be rather larger, but having observed that, I will take a figure to show the principle. I will assume a condensing engine, working under one pound to an inch in the boiler. Giving the vessel that speed in ordinary weather which you believe to be the extent of the speed of that class of vessels, you have nothing to do but to give the captain of that ship a safety valve of his own, under his own care and under his own lock; the engineer has nothing to do but to fire up to that point, and I will defy the ship, the engine, or any one thing to go wrong; because if the engineer attempts to fire above one pound to an inch, from that moment it blows and tells its own tale on the deck. If it does not keep up to it, the vessel will lose her speed; if the vessel is losing her speed, and the captain finds it out, he says to the engineer, "You are not up to your proper point; the vessel is not going at its proper rate;" and the engineer looking at the steam gauge, says, "I am up;" the captain will then put on two pounds to an inch, because he finds that there is a wind against him, and he thus increases his power to the limits at which his boiler is regulated; he knows the extent to which it can go, and there can be no question as to the mode of accomplishing it; believing, therefore, that there is nothing more reasonable than the mode I have described, that the thing is perfectly within the regulation of the captain, I have felt it my duty to state it to the Committee.

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1282. What was the position of the vessel of which you spoke, and what was it that prevented it making way?—She had not power enough to contend against the new obstacle, the gale of wind.

1283. Was it a vessel of the same power as the Margate vessels?—A much larger one.

1284. Was it a vessel that had the power of making herself go the usual rate of steam vessels?—I do not know her rate, but conclude so, as she is in repute as a passage vessel.

1285. Is your view to give vessels a degree of high pressure, to enable them, when the wind and sea is such as stops them from getting a-head with their present power, to overcome that sea and wind if the captain thinks proper?—I would certainly give a vessel that was my own, not only the means of going at her full speed upon a smooth surface, but her engine should possess such a quantum of extra power, under the charge of the master, that if he was opposed by wind, which is an obstacle which has no reference to the absolute speed of the vessel through the water itself, he would be able to meet that new difficulty.

William Lewis Newman, Esq. called in; and Examined:

1286. ARE you the Solicitor for the Corporation of London?—I am.

W. Lewis Newman,
Esq.

1287. Will you be good enough to state to the Committee the complaints that have been made respecting the injury caused by steam-boats?—There have been for a considerable number of years a great many complaints. I think the first time that my attention was drawn to it was in the year 1823 or 1824; but I have a memorandum with me, which, if the Committee will allow me, I will refer to.

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1288. Will you give the Committee a brief account of what has been done respecting them?—In the year 1824 great complaints were made to the magistrates of the extreme velocity of steam-boats about the Pool; it was then recommended, that public notice should be given to the masters and owners of the speed which they should use within certain limits between London Bridge and Greenwich; and then there was a communication had by a committee of the corporation with the elder brethren of the Trinity-house, for moorings for some of those boats, and I have a copy of a letter from Mr. Herbert, who was the secretary to the Trinity-house, respecting those moorings.

1289. Are all the papers which you have brought upon the same subject; upon the subject of steam vessels?—Yes, they are.

1290. Will you state to the Committee the general nature of them?—I believe I can state it very shortly. In consequence of those complaints in 1824, I gave notice to all the owners and masters of the steam vessels to comply with those orders. I believe they did comply with them, for no complaint was made for some time. In the year 1829 those complaints were renewed, and it was recommended then that the same course should be taken, to have this notice reported, and be given to the captains and owners again. By one of them, it was stated that he would comply; but I believe the others took no notice of them. The complaints continued to increase to a very great degree, and in the year 1830 the chief magistrate thought it his duty to direct me to prosecute those persons. I collected a good deal of evidence for the purpose; but the winter coming on, many of those boats ceased their voyages, and therefore it remained over to the present year. I had a great deal of difficulty in ascertaining at what speed those vessels went, and therefore the only course that I could adopt was to get persons to go on board the vessels, and to take notice at what time they started and what time they arrived at Greenwich. I have the reports of those men, and it appears that they went in about 20 minutes. I have collected a great quantity of evidence, sufficient to prosecute those parties; and it was my intention, if those injuries did not cease, to prosecute those persons in the Court of King's Bench.

1291. Under what law?—By the common law; because the sea is the King's highway as much as a common road, and any person doing injury on the sea commits an indictable offence.

1292. You have not tried those yet?—I have not.

1293. Have you had the opinion of any counsel upon that subject?—I did not feel it at all necessary.

1294. You think the law, as it now exists, is quite sufficient?—Yes; but the difficulty is, that it is a long prosecution, and it is not only one act, but it is a number of acts that are necessary in order to make it a common nuisance.

1295. You are aware of the Act of Parliament by which the Waterman's Company are regulated; do you consider that bye-law made under that Act to be in force?—The bye-law made under that Act is clearly in force; but I believe there has been a question started, whether those bye-laws could apply to persons who were not of the Waterman's Company.

1296. This bye-law would punish persons plying contrary to its regulations?—There can be no doubt of it.

1297. If a person were prosecuted for going above five miles an hour, would he not say that he was not under the Act?—Going at a greater speed, that is only upon the bye-law; and I take it that the bye-laws were made for the regulation of the Waterman's Company.

1298. Suppose a man gets clear of that bye-law, from not being one of the Waterman's Company, then you can attack him for plying without being one of the Waterman's Company, and fine him 10*l.*?—If he has committed any offence within that clause, unquestionably.

1299. Have you any difficulty in those prosecutions, from stating where the offence has been committed?—I think that can be remedied by the Act of the 7th of George the fourth, which says, that where offences are committed within one county, or within one hundred yards of the county, they can be brought within that county.

1300. Have you been deterred from bringing on those indictments, in consequence of the idea of a bill being about to be introduced?—Yes; because if the evil could be cured without prosecutions, it would not be necessary.

1301. Those

1301. Those prosecutions will be attended with considerable expense?—Yes; *W. Lewis Newman,*
they would be tried by a special jury; about 100*l.* each. Esq.

1302. From what you know of the complaints that have been made, would that mode prevent the evil?—I think so clear a case might be made out, as to call upon the Judges to give a severe censure, and that would deter others from doing it.

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1303. There is no summary mode which can be taken?—No summary mode.

1304. Have you any jurisdiction over those watermen plying to Greenwich in the steam-boats, under your Act?—I am not prepared to answer that question immediately.

1305. Is it not in the Act, that every one plying within a certain distance of the city of London, either boats or craft, carrying passengers, are within your jurisdiction?—They are under the City's jurisdiction if they are free watermen.

1306. Are not they all entered in the name of free watermen?—I am not aware of that; they ought to be, because if they are not they are subject to the punishment named in the Act of Parliament.

1307. Why then is the law not exercised?—It would not extend to those that go out of that part.

1308. But you have a power of punishing those within that part if they go beyond that?—I apprehend we have not, because that is an offence against the bye-law, and which bye-law only applies to those who are free watermen. Another question that has been mooted upon the subject is, whether they have a right to exercise that power in making a bye-law to that effect.

1309. But you think even the remedy of indictment would not apply unless you can prove several acts of misconduct against the particular vessel?—To have a common nuisance there must be repeated acts.

1310. And therefore the captain of one vessel might be guilty of the most flagrant act without being liable to this remedy?—He would not be liable to this remedy, but he would be liable to another; because Mr. Jones convicted a person for running down a vessel in the Medway, and there was one that they were about to prosecute, but they made amends, and they did not go on.

1311. Is it not the case that if any vessel, short of the Margate and Ramsgate vessels, which plies within the jurisdiction of the City, from Yantlet Creek to Windsor, shall go beyond the distance established by this Act of Parliament, you can punish him for so doing; that is to say, you can punish him if he belong to the Waterman's Company: if he does not belong to the Waterman's Company you can punish him under the Act of Parliament, for plying within that limit without belonging to the Waterman's Company?—Yes, subject to the difficulty that has been started, whether that bye-law is good.

1312. Are there not two cases of remedy?—The Act of Parliament says, here shall be a Waterman's Company established, and for all those who belong to that Waterman's Company bye-laws shall be made; of course the bye-laws only can attach to those who belong to that Waterman's Company; but then, for the protection of the company, the Act of Parliament says, that nobody shall ply on the water for hire unless they belong to the Waterman's Company, under the penalty of 10*l.* Then if a man be caught going faster than he ought to go, you presume, first, that he belongs to the Waterman's Company; but when you apply to him, he says he is not under the bye-law, and then the clause of the Act of Parliament bears upon him, and he is liable under the Act of Parliament to a penalty?—I perfectly agree that he is liable under the Act of Parliament; but supposing he were under the Waterman's Company, then the question would be, whether the bye-law is sufficient.

1313. Have you any thing to state to the Committee which you would recommend to obviate this evil?—The only way of regulating this evil is by passing a law to regulate their speed. I know that every person's observation is, that it is extremely dangerous to go upon the river with a boat.

1314. From your knowledge of the complaints that have been before you, you think that by regulating the speed evils would be prevented?—Clearly so; and in addition to that, they should be prevented from racing, and from following one another in order to pass.

1315. A number of those complaints have arisen from accidents arising from the speed of those steam vessels?—Exactly so; and from their wilfully endeavouring to overrun one another.

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1316. Are all offences committed upon the river, within the boundaries of the conservatory of the river, cognizable before the Lord Mayor?—Some of the Acts have given that power, some of them have not.

1317. Supposing you were not to adopt a provision regulating speed, would not the consequences of the neglect and the ill conduct of the masters be very much prevented, provided a more summary punishment were imposed?—Any bill that could be brought in to give summary jurisdiction would have that effect.

Jovis, 22^o die Septembris, 1831.

Mr. *Anthony Lyons*, called in ; and Examined.

Mr. *A. Lyons*.

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1318. YOU are a Barge-master?—I am.

1319. You are an owner of craft?—Yes.

1320. You have a general knowledge of the river connected with the trade as to barges and otherwise?—Yes, I have.

1321. Can you speak of any inconvenience that arises to that part of the trade by which your craft is affected, by steam-boats?—I am a considerable sufferer from the surf made by the steam boats driving the barges against the vessels ; we cannot keep our barges together through the rapidity of the steam vessels making such an undulation in the water.

1322. Does that arise from the rapidity?—Of course it does, from their going through the water so quick.

1323. At what speed do they go?—I should think from 10 to 12 knots an hour ; my craft principally lies at Deptford, where they are more affected, because they do not slacken their speed.

1324. Does that apply to the trade generally ; do the trade suffer materially in their craft by that irritation?—Very much so, they cannot keep the craft together.

1325. Are you put to considerable expense in repair in consequence?—Yes.

1326. Does this also apply to your loading the barges?—We cannot load them but very little more than two-thirds to what we used to do, and therefore it is a considerable loss in that respect.

1327. You are obliged to keep the same number of men, though you load the barges only two-thirds?—Yes.

1328. And all your expenses are the same as if they were fully loaded?—Yes.

1329. With respect to being loaded two-thirds, have they sustained accidents?—Yes ; if the barge lies at the head of the ship it goes up and down, it tears the heads off, it tears the bits out of the barge sometimes.

1330. Does she take in water from that motion?—Yes, a great deal of water.

1331. And you have had goods spoiled by that?—Our goods are deals, so that we are not injured, it is only the other barges that suffer.

1332. Have you known of any barges being sunk?—Yes, I have had a large barge of my own sunk. The steamers were going down one after the other, and the water rolled in till she was filled, the tide set in her so that the water rolled in.

1333. Has any injury occurred from a single steam vessel going down?—It does not make so much, but the large vessels make a great deal of surf.

1334. Have you experienced any injury from single vessels going down?—Not so much as if there were more going down : the barges do not knock against the vessels certainly, if there were only one, as if there were two or three going.

1335. What rate do you think, if they went through the water, could they go, without doing that injury of which you complain?—I should think five miles an hour ; it depends in a great measure upon the size of the steam boat, those of a larger beam make more surf than those of a smaller one.

1336. Is there anything else that you can state to the Committee, that you would suggest to the Committee as obviating the evil?—I should like to suggest their stopping at Blackwall.

1337. You

1337. You think that would be very desirable for the trade in general?—Yes.
1338. That would be rather injurious to the trade of wharfingers and others?—It might to a small degree.
1339. The wharfingers receive a good deal of money from the landing of passengers, both at the St. Catherine's docks, and the other wharfs?—I think that is hardly a consideration for the damage that is done.

Mr. William Evans, called in; and Examined.

Mr. William Evans.

1340. YOU are a Ship-builder?—Yes.
1341. Where do you practise as a ship-builder?—At Rotherhithe.
1342. Have you built any steam vessels?—I have built or superintended the building of between 40 and 50.
1343. What size is the average?—The average size about 200 tons, that I have built.
1344. How long do you think a steam boat, built with proper scantling, can run with safety, without being repaired, provided there is no accident?—They ought to have a good overhaul after five or six years; there is a liability to dry rot.
1345. Do you think them quite safe, then, for five or six years?—I cannot say that, because the dry rot sometimes touches them at the end of two years.
1346. In short, an annual survey would be most secure?—They ought to have an annual examination.
1347. Whereabouts is it, in the upper or the lower timbers, that a steam boat first fails?—Between wind and water is the most likely place.
1348. Have you, in fact, examined any steam-boats that have plied for any length of time?—Yes, some of 10 or 12 years old.
1349. And whereabouts do you find that the failure first occurs?—Sometimes under the boilers, but they vary; but the part in which it is most likely to occur is between wind and water.
1350. Is it not the case in steam-boats, that close to the boilers the upper timbers is the part that first gives way?—They generally get very tender, unless they are well lined over.
1351. In the steam boats that you have built, do you make a practice to put the timbers close together, so as to caulk them before you put the bottom on?—It is not a practice of mine.
1352. Is it the practice in any that you have built?—Up to the floor head in several of them that I have built.
1353. Therefore if the planking came off the bottom, she still would float?—They fancy so, but no ship put together on that system could float.
1354. There was an instance given yesterday of a Dublin steam-boat, that got off Margate, and had a large piece of her bottom knocked off, and the people in her did not know that anything was the matter with her till they arrived at Dublin, when they found it out. Did you hear of that?—Perhaps it was a piece of the sheathing; I should hardly suppose it was a piece of the main planking.
1355. In point of fact, you do not build your steam boats in that way, do you?—Not of my own choice; where it is optional to me I would reject the fillings.
1356. How near do you put the timbers to each other in the steam-boats you build?—When the timbers are put in the old fashioned way we put them about the same space as the timber, about six inches.
1357. Do you make the scantling of the steam-boats stronger or less strong than the frame of other vessels?—They are generally about the same, I think, upon the average.
1358. Do you charge more or less per ton for building them?—The price is rather more, I think, upon the average.
1359. Why is that?—There is a great deal of framing and cross beams attached to the engines, which makes the price more.
1360. That is for supporting the engine, and not with a view to strengthen the vessel?—The additional price arises from the framing to support the engines.
1361. How long is it since you began to build steam vessels; when did you build your first boat?—About 14 years back.
1362. Is that boat which you first built now running?—She is laid up as a steam vessel.

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1363. How long has she been laid up?—A year and a half.
1364. During the 12 years that she was running, do you know how much repair she got, and how often she was under repair?—She was not often in my hands, but she was repaired every one or two years in a temporary way; there was no extensive repair upon her.
1365. What was the power of her engines?—Twenty horses; two tens.
1366. What was the size of the boat?—Eighty tons.
1367. What is the largest boat you have built?—The largest is the Ramona.
1368. What size is she?—385 tons.
1369. What engines has she?—A pair of fifties.
1370. How long has she been running?—This is the fourth season the Ramona has been running.
1371. She, of course, has had no repairs yet?—I think she has not had the value of 6*d.* spent in repairs. I ought to notice her construction: her frame is only half the usual weight; the whole of her frame is so bound that there is no possibility of the joints of the timbers working out, as was the case with the Rothsay Castle. In vessels of the old construction, the more the timbers are caulked the more they separate.
1372. Will you explain how it is that the caulking of the seams affects the timbers?—It separates the joints of the timbers where the timbers are short, as they are in the old plan; a frame is composed of six or eight pieces of timber, which in the Ramona is bound into one; it is more expensive timber on account of its greater length, it is lighter, and a great deal stronger.
1373. Have you built any sailing vessels on that plan?—I have not; I have built about six of the steamers on that plan.
1374. Is it more or less expensive?—Rather less expensive, from the frame being so much lighter.
1375. Have any other builders adopted that mode of building?—None that I know of; it was proposed, but no one had confidence to push it on; I took it up, and was at the time injured by it. The vessels were said to be not seaworthy, but they have proved the contrary.
1376. Has any vessel so built been aground in a sea-way?—The Ramona went aground at Boulogne, at the time the Columbine sunk there with all her force, without the least damage to her.
1377. Was there much sea at the time?—Not a very heavy sea.
1378. As a builder, do you think the vessel to be stronger or weaker?—A great deal stronger.
1379. Did one of your own vessels, built in that manner, go to the East Indies?—The first one built in that manner went to the East Indies, it was the Emulous.
1380. Had she her engines in at the time?—Yes.
1381. But did not use them?—No; she was not able to carry fuel; she was built for a racer; very fast and very strong.
1382. What water does the largest vessel, the Ramona, draw, when she has her coals and every thing on board?—Under seven feet; six feet nine.
1383. How is the Emulous employed now?—Towing ships on the Ganges.
1384. In all the steam-boats you have built, are all the paddles the common fixed paddles?—Yes, in all cases where I have built; I did fit up a vessel on revolving paddles.
1385. Can you describe what sort of revolving paddles those were?—They were on Mr. Skeen's patent, leaving the water perpendicular and touching it perpendicular; it is a paddle-wheel, but the paddles themselves, by their own weight, keep a perpendicular position, that is, they turn upon a pivot, each individual paddle. It is no use at all.
1386. You fitted one that way?—I did.
1387. How did she answer?—Not at all.
1388. Did you put the common paddle afterwards to her?—She had the common paddles before.
1389. What became of her afterwards?—I do not know.
1390. How do you know it did not answer?—By making a trial or two in the boat.
1391. What sized boat was it?—A very small thing; about 20 tons.
1392. How low might the Ramona be brought, so as to be safe?—She might be brought down with safety to nine feet, and would still be safe to go to India.

I should

I should mention one fact relating to the *Ramona*; she was built for the express purpose of running to Calcutta for the reward offered there; the party failed, and left me a heavy loser.

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1393. If you were employed as a builder to survey a steam-boat to declare her seaworthiness, how would you proceed; where would you examine her, and how would you examine her?—All over, in fact, to try the caulking work; the caulkers are set to work, they find out the sore places, and they probe every part of the plank.

1394. Would you not consider it necessary, before you had declared her seaworthiness, to take off some of the lining to look at her timbers?—I should take a piece or two from the inside; two or three pieces taken from the inside would be sufficient to ascertain the state of the timbers.

1395. Whereabout would you do that?—Between wind and water.

1396. Would you insist upon taking out the boilers to do that?—I should not insist upon that; I could ascertain without.

1397. Would you make your principal examination in the neighbourhood of the boilers?—I should examine more closely in the way of the boilers, but there are other parts to look at, as well as the boilers.

1398. But you would not consider that you could give a certificate of her seaworthiness, until you had looked at the timbers about the boilers?—Not till I had made a thorough overhaul.

1399, 1400. What delay would that generally cause; what time would it take to examine a steam-boat as to her seaworthiness?—If the vessel, on close inspection, turned out sound, one day would be sufficient.

1401-2. How long would you be yourself in examining a vessel, with regard to her seaworthiness?—I should order the caulkers to probe the ship, and attend the same day to examine the defects that they might discover. The second survey would determine whether a further repair was necessary.

1403. Would it be left to the caulkers to report?—The caulker examines the planking, and he marks all defects.

1404. Suppose there is no defect in the planking, but the timbers are rotten?—The only way to ascertain that is to look at the inside of the timbers.

1405. Who would examine to find that out?—The surveyor would do that.

1406. If you were appointed, being a ship-builder yourself, to declare whether a steam-boat was seaworthy or not, how would you proceed, and how long would it take you to make up your mind respecting her?—It would take the second survey on the same day.

1407. How would you proceed, what would you do?—By setting the caulkers to work to mark out the defects in the plank, examining the timbers inside myself; I could not determine upon the first survey, without afterwards looking at the defects.

1408. What would be the charge for such an examination?—There are various charges; I should charge five guineas for a survey.

1409. That does not include the workmen?—Not at all.

1410. Nor the caulkers?—It includes nothing but my own fee.

1411. What would be the expense to the owner for having that done, upon the average, supposing there is nothing the matter with the vessel, and you have only to replace the planking you have ripped up; what would be the expense?—A ship builder has to pay as much for overhauling as he has to pay upon the caulking it; in many places no materials are required, but it is paid as if it were fresh caulked.

1412. Supposing such a survey as you have mentioned to declare whether a vessel was seaworthy, you would look at the timber in two or three places, and you would tell the caulkers to examine the caulking all around; but supposing that the vessel does not require any caulking, but merely the replacing of that timber that is open, what would be the expense to the owner, including your fee and those men employed?—It might cost 10*l.* or 12*l.*, according to the size.

1413. In your opinion would an annual survey, generally speaking, be sufficient for general purposes of security to ensure the safety of a vessel?—Yes, I think an annual survey is sufficient.

1414. Do you think that a sea-going vessel requires a more frequent survey than a vessel going upon the river?—I do not see any difference in that respect; a vessel on the river is liable to so many blows which a ship at sea is not.

1415. Supposing you were constantly employed upon that work, and were selected by the Custom-house for that work, to survey all the vessels that ply in the river Thames, should you charge so much as five guineas for each?—Certainly not.

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1416. How much lower would you do it, if you were so generally employed?—If I had to survey all the steam vessels in the river, I should charge a couple of guineas for each.

1417. Annually?—Annually.

1418. You have just told us that the whole expense of survey amounts to 12 *l*. Would a diminution in the same proportion as in your own, be allowed in the other charges you alluded to; in caulkers, and so on?—That would not, I think, be reduced.

1419. In the steam-boats that you have built, and that you are acquainted with, are there any of them built without plank lining; are the timbers exposed in the inside?—Some of them are built without the inside plank.

1420. Do you approve or disapprove of that practice?—I approve of the inside plank.

1421. What is the advantage of it?—It adds so much more strength to the ship.

1422. If you were to give an increase to the timbers in proportion to that, do you not conceive that there would be an advantage in keeping the timbers always in sight, to secure them from being decayed without the knowledge of the commanding officer?—That is Sir Robert Seppings' practice, to leave out the inside planking; but I do not approve of that myself.

1423. Do you conceive that the engine requires to be surveyed as often as the vessel?—Yes, certainly; they require an annual survey as well as the ship.

1424. Have you any recommendation with regard to steam vessels, to give to the Committee?—I would merely recommend such a vessel as the *Ramona* in preference to any other.

1425. As steam-boats are now built, do you conceive that it would require a very great increase in the size of the timbers to make them as strong without lining as with?—The timbers add to the strength of the vessel crossways not lengthways, which is the more essential from the steam vessel's great length.

1426. Would not a diagonal timber between the other timbers answer that purpose?—There is not room for diagonal timbers; I use, wherever I can, a diagonal plank; I place the inside plank diagonally.

1427. Do you use diagonal plates of iron, in order to strengthen your vessels, fore and aft?—Yes, all fore and aft.

1428. But still you think the lining necessary for the fore and aft security?—I do.

1429. Do you think that the timbers, in the case of a vessel that has spouses, are liable to decay in consequence of the heated air between the spouses and the side of the vessel?—The decay is certain.

1430. If you had a commission to survey a vessel, should you as a ship-builder consider yourself competent to survey the engine as well as the vessel?—Not the machinery of it.

LETTER from Mr. Evans, Ship-builder.

(IN my examination by the Committee on Steam Navigation, I am fearful that some of the questions put to me were, from my deafness, not well understood, and therefore not correctly answered: I should be glad to explain what, under such circumstances, must be very imperfect.

The principal point the Committee appear to require my evidence on, is what kind of survey or scrutiny a steam vessel should undergo to ascertain her seaworthiness. I reply that a vessel should undergo an annual survey by competent shipwrights; being put into a dry-dock, and her outside planks or fastenings probed or searched by caulkers, who will mark every defect, which defects are afterwards cut out by shipwrights as far as they extend. The surveyor has thus an opportunity of seeing what repair is necessary. In some cases the butts, that is, the ends of the planks, only require to be caulked; in other cases the seams all want new caulking, and pieces of the plank cut out, and replaced with new; and in very many cases the planks and timbers may be all sound, and yet the vessel not be seaworthy, from the bolts and treenails working loose: if the bolts are iron they are not safe, in my opinion, for more than seven years wear in salt water; of course they will run longer in fresh water.

Copper bolts are also liable to get loose, but do not corrode in the same degree as iron; both copper and iron, where loose, should be drove out, and larger bolts drove in the same holes. To complete the survey, about four pieces of the inside plank, or lining, should be taken out, in order to see the state of the vessel's timbers. The part of the vessel most liable to strain and decay is just abaft the boilers: this arises partly from the shrinking of the wood by the heat, and also from the alternate weight of the boilers, or the water they contain being often emptied to clean the boilers. The defective part of the timbers are more likely to be found about the height of the load water line. After making the above survey I should give a certificate of the vessel being seaworthy.

Another

Another inquiry the Committee made of me as to the propriety of making the timbers all solid, or close to each other, so that the timbers may be caulked, and the vessel made safe, in the event of going ashore and losing a plank from her bottom. I do not approve of this plan, for the following reasons: the frames of steamers, as generally built, are strong enough, therefore any addition of weight is not only useless but injurious, by reducing the speed, and consequently the safety when the vessel has to make way against adverse winds; the most critical position a steam vessel can be placed in.

To make the frame timbers all close nearly doubles the weight of the frame; this addition of weight is partly counteracted by reducing the inside plank: this last omission is a serious evil, as steam vessels, from their great length, require to be strengthened length ways, which can be best done by using the inside planking, and also iron diagonal plates, bolted through every timber they cross; the inside planking should also be wrought diagonally.

I have been employed as a ship-builder in constructing near fifty steamers, one of which has been wrecked: she was built by me for the General Post-office, but under the inspection of the Navy Board surveyors. I am not acquainted with the details of her loss, but merely with the fact of her being wrecked at Weymouth, or thereabout: her name was the Meteor. Another vessel, built on the same construction, with close timbers, has also been wrecked: her name was the Dasher: she was also built under the inspection of the Navy Board. None of the other steam vessels I have been concerned in building have been lost, although they have been severely tried in the English and Irish channels, in the voyage to India, to South America, and in the Mediterranean.

Steam vessels are also liable to be much strained by the way in which their engines are fixed, that is, on each side the centre of the vessel, distant from the keel from three to five or six feet: the evil is felt when the vessel lays a-ground. Some steamers alter the form of their cross section full two inches every time they take the ground; of course the fastenings are gradually getting weaker by every alteration in the vessel's form.

In the year 1822 I proposed to the Holyhead Committee to obviate these objections, by placing the engines in the centre of the vessel, so that when the vessel lays a-ground the weight of the engines being on the keel, there is not that liability of the vessel straining. This mode of placing the engines also allows the midship section to be sharp, or to have great rise at the floor heads, and the weight being kept low the vessel has more stability, has a better form, is able to carry sail, and to beat off a lee shore in the event of her engine's being deranged; greater velocity can also be obtained by this arrangement; and, of course, a vessel that can sail well, independent of her machinery, is more safe than another vessel having more imperfect sailing qualities.

The experience I have had of steam navigation since the year 1822 convinces me that steam vessels of greater strength, speed and safety, may be constructed on the principle recommended by me in the year 1822, than the present line of steam vessels. I have before objected to increasing the weight of the frames of steam vessels; on the contrary, I have reduced the weight of the frame one-half, and added to the planking, and the result has been perfectly satisfactory.

In the year 1823 I proposed to the Admiralty, in conjunction with Baines and Miller, engineers, to construct a steam vessel of 500 tons, and 160-horse power, built to receive engines in the centre, and with cylinder boilers high pressure, all to be placed below the vessel's water line, so that the boilers would have been in some degree shot-proof, and the vessel's sailing properties superior to any vessel of her tonnage in the Navy. In an interview with Sir G. Cockburn, at the Admiralty, I did not meet with encouragement; but the plan of cylinder high-pressure boilers, I understand, has since been adopted by the Admiralty.)

Mr. John Lee Stephens, called in; and Examined.

1431. WHAT is your profession?—A few years since I was a ship-owner and merchant; at present I am an auctioneer and general agent.

1432. You have stated that you can show to the Committee how the danger to wherries from steam-boats may be entirely avoided, and this upon demonstrated data. What is the plan by which you effect this?—I found my assumption on the introduction of an invention which I endeavoured to bring before the public about two years and a half since, or three years, the capability of which invention was demonstrated in the City Canal, Blackwall, I think in October 1828. The model of the invention I have before me, and its effect was to do entirely away with the creation of back-water occasioned by the common paddle-wheel, in consequence of the angles of immersion and emersion of the common wheel, together with the following of one paddle continually in the path of its predecessor, and the fact of the wheel being at all times propelled or rather driven round at a considerably greater velocity than the vessel could be propelled at leaving it, as a consequence that those paddles following in succession should on all occasions have to act on a body of water already disturbed, instead of acting upon a steady fulcrum.

1433. In short your invention is to prevent the sea, and to prevent the danger arising from it to wherries?—Precisely.

1434. Has it been carried to practical effect?—As far as demonstration goes, it was carried into effect on a boat of 18 ton, on the City Canal, in October 1828.

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This boat had been employed for the purpose of taking passengers to and from the Temple, I think to Richmond, and was propelled by means of winches and manual labour, having on each side a common paddle-wheel of the requisite dimensions attached. This boat I had taken into the Thames, and marking the state of the tide, she was propelled from opposite the Temple Gardens, I think, to Vauxhall Bridge with the common wheel in a given time. This boat with a common wheel was taken on the City Canal; the usual quantity of back-water was the result of the action of the wheel, in proportion to the size. Those paddles being removed and mine attached, this boat was then propelled without the creation of any back-water whatever. Subsequently to which, and in order to satisfy some scientific gentlemen who superintended the experiment, I had the paddle-wheel attached to one end of the shaft; and when those paddles were propelled with a given velocity, the common wheel left its usual train of back-water on one side of the boat, while my paddles on the other side left the water undisturbed.

Veneris, 23^o die Septembris 1831.

Mr. Robert Pearce Cruden, called in; and Examined.

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1435. ARE you one of the Jurats of the Corporation of Gravesend?—I am.

1436. Do you conceive that the interests of the corporation and inhabitants of Gravesend are materially involved in this inquiry?—Very materially.

1437. Are you prepared to furnish the Committee with any statement of the Steam Navigation on the river, between Gravesend and London?—I have had frequent opportunities of making observations upon it, which, with the permission of the Committee, I will state. It greatly affects the town of Gravesend, inasmuch as the resort of persons by steam conveyance forms the chief source of the subsistence of the inhabitants, the numbers annually passing from London to Gravesend being about 120,000. I conceive that the accommodation rendered to the public is acceptable by the numbers adduced. With regard to the regulation of those boats, I humbly conceive that they are now admirably managed and admirably conducted, but it has arisen that sometimes the boats are so crowded as to make it a question whether it might not be expedient to restrict their numbers. But I submit, from long experience, that unless that is liberally done it will be inoperative, because there are several Acts of Parliament restricting the numbers to be conveyed by sailing-boats, and that number all my life has been exceeded without leading to prosecutions for the offence. I have certainly, having had my attention drawn to it, considered that they might safely be conveyed to the amount of four to each ton. I am speaking now of boats in the river, without reference to boats on the sea, and without computing on any scientific data, but from the known tonnage of the vessels, and the numbers that I know them carrying; I confine myself to the boats between London and Gravesend.

1438. Have you known of your own knowledge any inconvenience arising from an over number of passengers being crowded in any boats?—I cannot say that I am aware of any; on the contrary, from the numbers, as I have already stated, notwithstanding they are so large from Gravesend, that I believe the boats of one company have conveyed little less than 250,000 up and down, reckoning both passages, and I have never heard of any accident of life or limb arising at all from these boats.

1439. Why do you recommend any regulation upon this subject?—Because I have seen others loaded, as I believe, dangerously; but these boats are not so loaded as others I have observed.

1440. How many men do they take a ton?—I have never travelled when they have exceeded four per ton.

1441. When you say 250,000 persons, upon what grounds do you calculate that number?—In consequence of an Act of Parliament which passed two years ago a toll of twopence a head is allowed, and having audited these accounts I can speak of it on my own knowledge.

1442. In what time?—Since the passing of that Act, two or three years ago.

1443. Is that toll levied upon every person who is set down short of Gravesend,
or

or only of those that make the whole voyage?—Only those that come within the incorporated towns of Gravesend and Milton. Mr. R. P. Cruden.

1444. What distance is Milton from London?—It adjoins Gravesend; the corporation of Gravesend consists of the parishes of Gravesend and Milton. 23 September,
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1445. Are there two Miltons in Kent?—Yes, near Faversham there is one.

1446. You state that the number of persons coming to Gravesend, and the advantages to that town, have been much increased by the increased speed which has been given to those packets?—Most undoubtedly, the numbers were formerly nothing like what they are now.

1447. In what proportion is it increased?—I should think very much indeed, so that we have been sometimes four or five hours in going against the tide, and it may now be done in three hours. With regard to the speed, it is of great importance to men in general, and especially mercantile men, who require to be in London early in a morning to fulfil their duties; to them, therefore, speed is necessary, for they could not avail themselves of that conveyance otherwise.

1448. What rate would you say they ought to go?—I think that a boat going to London in three hours can go with perfect safety; we compute the distance 30 miles; I by no means say that that is a rate that I should think safe in all parts of the passage, that may be restricted under circumstances; but I submit, with reference to the progress in the Pool, there are material obstructions, which, if removed, the boats might go with greater speed than during the continuance of those obstructions.

1449. Will you have the goodness to state what those inconveniences are?—I have myself borne witness to a fact. The master of a steam-boat, who is in attendance to speak to the minutiae, called me forward to observe it: a lighterman had lashed two boats together to obstruct the steam-boat; at the suggestion of the master I went forward, and found them so lashed, and I believe that the lightermen have made too much of the inconvenience arising from steam-boats.

1450. Will you describe how these lighters were lashed?—I have already stated to the Committee that I was witness to the fact of their being lashed, and that the master of the boat was here to speak to the particulars.

1451. Cannot you speak to the particulars?—I saw them so lashed, that the two lighters spread over so much of the Pool that there was no safe passage on either side, and we were obliged to wait for an opening to pass them.

1452. Were they lashed side to side?—They were lashed forward at an oblique angle.

1453. Their bows were lashed?—They were made fast forward by the head.

1454. That is to say, they were lashed inconveniently; had the master anything to induce him to think that it was intentional?—I could perceive no motive for lashing them together.

1455. Have you any reason to think that it was done intentionally?—I am not aware of any other object.

1456. Is there any law that you know of that prevents boats lashing in that way?—I apprehend it would be an obstruction to vessels and business; there was only one man in these two lighters, and it is expressly against a bye-law that one man should steer two boats at once.

1457. That would be an equal obstruction to a sailing vessel, would it not?—A sailing vessel would not be so much impeded, because she might work round.

1458. If she had been going free?—She would have been equally obstructed.

1459. Would not a steam vessel be able more easily to move than a sailing vessel?—Yes.

1460. You say that two lighters, with only one person in charge of the two, is contrary to a bye-law now existing; did you take any measure for enforcing that bye-law?—Certainly not. I submit a public notice, issued by the corporation of London, signed by the Lord Mayor, Mr. Alderman Lucas, at that time, which I take to be a very important document for the navigation of the river. This arises from an authority given by several Acts of Parliament to the corporation of the City to regulate the vessels in the Pool; they make bye-laws, and have an establishment of harbour masters to carry this into effect, and the bye-laws enjoin a passage of 300 feet to be kept in the mid-channel, and a passage of 40 feet on each side between the shore and the inside of the tiers. I submit, if that were done, a great facility would be afforded to the passage of all vessels up and down, and particularly

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ticularly to the security of small boats, because they would then have ample room, 300 feet, to avoid steam boats.

[*The Witness delivered in the notice.*]

1461. As your attention has been very much directed to the navigation of the river, are you not aware that from that time there has been a considerable degree of improvement with regard to the lying of the vessels?—I am aware that from the complaints of a Dock Company, more attention has been bestowed.

1462. You are aware that the Corporation took some pains at that time, and that there was considerable improvement made, and more room was afforded for boats to moor?—I am aware that in 1829 those bye-laws were made by which this was ordered, but they have not been carried into effect.

1463. Has it not been improved?—I should think it has; but it is in a very confused state still.

1464. You think the regulations are salutary?—Yes.

1465. But not completely so?—No.

1466. When was it that the boats were lashed against one another?—A few months ago.

1467. Are you not aware that these bye-laws are carried into effect by penalties; is it not open to the public and any person suffering to make complaint?—To make a complaint to the committee; but I am not aware that they have been made by individuals.

1468. You never have taken that step?—I never have taken that step.

1469. Was this obstruction which you met with, when you saw those two barges lashed together, in a part of the river which ought by this regulation to be 300, or was it where there ought to have been 40 feet width?—That where there ought to be 300 feet, because it was in the mid-stream.

1470. What distance was there at that time between the crafts where there ought to have been 300 feet?—I should consider considerably under 300 feet; speaking at random, because it can only be matter of recollection, not more than half the space.

1471. Of that 150 feet, how much do you suppose those two barges, so fastened as they were, occupied?—I should suppose the barges may be 45 feet or 50 length, one lying obliquely; but then the spaces between those vessels were crowded with other boats.

1472. What breadth of that 150 feet space do you conceive that those two barges, situated as you saw them, occupied?—I should think that they might have occupied 60 feet at the angle at which they lay.

1473. With regard to the other 90 feet, can you inform the Committee how, at that moment, they were occupied?—Occupied by other craft and small boats, being, as they usually are at that time of the tide, going up.

1474. Were you going up?—Going up.

1475. Then all those boats were using their best endeavours to get on?—We were endeavouring to go a straight course, but many of those craft were drifting up athwart the tide.

1476. There were some of them that were making a straight course, and others were barges dropping up?—Precisely so.

1477. You might have followed the boats that were going up, though they did not go as fast as you; you could have gone at the same pace as those boats were going until you had passed those two barges?—Undoubtedly.

1478. How long do you suppose it would have detained you so to follow the fastest rowing boat that you saw on either side, until you had passed the passage occupied by those barges?—I do not know.

1479. How long do you suppose it would take the boat?—A few strokes of the paddles might carry her through in a minute, if room was left to pass.

1480. Were those lighters moored, or were they afloat?—They were drifting up with coals in.

1481. So that the only thing you complain of is, that the boats were fastened together?—Yes; it was wanton obstruction.

1482. Do you mean to say that you think the purpose of the men, in lashing them together, was to obstruct?—Yes, I think it was; appearances indicated it.

1483. Is there any other obstruction that you have witnessed?—That is the only one I have witnessed of a wanton obstruction; circumstances indicated that it was entirely wanton.

1484. There

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1484. There was no conversation took place?—A good deal of abuse.

1485. Have you an ancient right to govern the ferry from Gravesend and London?—We have; and one which it is of great importance to us should not be interrupted, because the passage by that ferry forms the whole source of subsistence for many of the inhabitants; and there is an ancient right for that purpose, referring to former dates.

1486. With reference to Gravesend, you have stated that there is a class of persons that are interested in the velocity of steam-boats between Gravesend and London; is there any class of persons resident in Gravesend independently of those you have spoken of, that are so interested?—I apprehend that those who come from the country to market are interested in their coming quickly; in fact the celerity of passage is an object to all persons.

1487. At what pace were you going at the time you just spoke of?—We were going at an easy rate; I cannot take upon myself to state the velocity.

1488. Do you often pass through the Pool?—Yes.

1489. At what rate?—Various rates.

1490. Do not they go faster than they ought to go?—I think sometimes they ought to go as fast as they can. I cannot say that I have witnessed danger in the Pool from the velocity at which they were going. I have seen the boats going at a speed which perhaps might be better abated; but I cannot say it was attended with danger. The impression on my mind is that the masters wish to avoid danger.

1491. Have you not seen a great swell?—I have seen a great swell arising from them.

1492. Have you ever seen any water thrown into wherries?—Yes.

1493. Have you seen any swamped?—I have seen them crowded together.

1494. Have you heard of accidents?—Most undoubtedly; and I may be permitted to add, that there has been distributed a list of 43 accidents, only one of which happened with a Gravesend vessel.

1495. You do not know of that from your own knowledge?—I do not know of that accident from my own knowledge.

1496. You have stated that three hours is the time that the boats took?—On the flood-tide, all things being favourable.

1497. And that is a speed convenient for all men going to market or coming up on other business?—Speaking for myself, that is sufficient for me.

1498. Do you not know that in point of fact they do it in less time than that?—Yes, they do, I believe; they have done it in two hours and a half: I believe that is with a favourable tide.

1499. You imagine that an average of three hours would allow for the time that is reasonable in slackening the velocity of the vessel in critical situations?—I should think so.

1500. In going in three hours it would require them to go on an average of ten miles an hour all the way?—The distance computed would be 30.

1501. If you were a proprietor of steam-boats, knowing now the effects that a steam-boat has, and knowing the powers of a rowing boat, would you think it safe or proper if any vessel, not merely a steam vessel, were allowed to pass backwards and forwards at the pace of 10 miles an hour?—I imagine that 10 miles an hour is too great for the Pool.

1502. What distance is Gravesend from London by land?—Twenty-two miles by land; the twenty-second milestone stands in the town.

1503. What time would coaches take to go that distance?—Two hours and three quarters.

1504. You think it is essential that they should take them in good speed?—I apprehend persons wish to go as quick as they can.

1505. Supposing a man starts by the steam-boat at Gravesend, and the other starts by the coach, which gets in London first?—I apprehend, the tide being favourable, they would get in town just about the same time.

1506. The tide being against, the coach would get in first?—The coach would get in first.

Mr. *John Matthews*, called in ; and Examined.

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1507. ARE you the Town Clerk of Gravesend?—Yes.

1508. Are you a Solicitor?—Yes.

1509. Are you prepared to prove the chartered right of the town of Gravesend, with respect to the ferry?—I have some papers here relating to it.

1510. Will you read them?—The 2d of Henry the fourth, 1401 ; 4th of Queen Elizabeth, 1562 ; and the 7th of Charles the first.

1511. State what the earliest charter recites, with reference to the ferry?—The grant of Henry the fourth states, “ That from time whereof the memory of man is not to the contrary, the men of the town of Gravesend, who in their times have successively inhabited the town aforesaid, have been accustomed and were used, without any interruption, freely, quietly and peaceably, to carry in their own vessels whatsoever persons coming to the town aforesaid, and from thence, willing to go by water to our city of London, until now lately certain persons of our city of London aforesaid, not having consideration for the said custom, for so long time without interruption used and continued, have come from the same, our city of London, with their vessels to the said town of Gravesend, and there have shipped such persons willing to go to our city aforesaid by water, and have converted the money therefrom received to their own use, contrary to the will of the inhabitants in the said town of Gravesend, to the grave injury of the men of the same town, and contrary to the customs aforesaid, so that they who now inhabit, whose vessels are the substance of their livelihood, dare not, as they say, for fear of damage and loss, ship any persons towards our city aforesaid as heretofore they have accustomed : We, the supplication of our dear lieges of the said town of Gravesend to us in this behalf made, being inclined of our special grace in relief of the same our lieges, and to the end that they the better and more securely may live and inhabit the same town of Gravesend, have granted as much as in us is, to them who now inhabit the town aforesaid, and to their heirs and successors whomsoever, that they, in their own vessels, may for ever freely ship such persons coming to the said town of Gravesend, and from thence willing to go to our said city of London by water, taking for every such person as in times past shall have been duly used and accustomed, without disturbance or impediment of us or of our heirs, or the ministers of us or of our heirs, or of any others whomsoever. In testimony whereof, &c. Witness, the King at Westminster, the 6th day of September.”

By Writ of Privy Seal.

1512. That was a charter, was it?—Yes.

1513. Have you ever had that confirmed by Act of Parliament?—It has been recognized in various Acts of Parliament.

1514. Which is that?—An Act passed in the 9th of his late Majesty George the fourth. It recites that, “ by a Charter of his late Majesty King Charles the first, bearing date the thirtieth day of March, in the seventh year of his said Majesty's reign, the foreman, jurats and inhabitants of the villages and parishes of Gravesend and Milton, in the county of Kent, were incorporated by the name, style and title of ‘ The Mayor, Jurats and Inhabitants of the Villages and Parishes of Gravesend and Milton, in the county of Kent ; ’ and the whole passage or ferry upon the river Thames from the said villages and parishes to the city of London, and the sole liberty of such passage or ferry, and all and singular the profits, commodities and emoluments belonging and appertaining thereto, were granted unto the said mayor, jurats and inhabitants ; and the said passage or ferry is governed and regulated by the mayor, jurats and common councillors of the said villages and parishes, in pursuance of the said Charter.”

1515. What does that Act go on to enact?—To authorize the erection of a pier, and to make regulations for its maintenance, and imposing a toll on persons using the ferry.

1516. But it does not enact the right?—It recites the charter, and states the fact.

1517. When this Act was passed in the 9th of George the fourth, there was this Act, which is at variance with your having the right of the sole maintenance of the ferry, because it confines it to the Waterman's Company : “ If any person, not being a freeman of the said Company, or an apprentice to a freeman, or to the widow of a freeman of the said Company (except as hereinafter is mentioned), shall at any time act as a waterman or lighterman, or ply or work or navigate, or cause to be worked or navigated, any wherry, lighter or other craft upon the said river,
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from or to any place or places, or ship or vessel, within the limits of this Act," which extends to Yantlet Creek, "every such person shall forfeit or pay for every such offence any sum not exceeding 10*l*." Did the corporation of Gravesend, when this Act was passed, petition against it, or state their rights, insomuch as it was at variance with them, when this was before the House of Commons?—No; and for this reason, there is a reservation of the rights of the inhabitants of Gravesend and Milton in that same Act of Parliament.

1518. Is the passage to London called a ferry in that charter?—Yes, the Long Ferry.

1519. Does the Act of the fourth of Elizabeth state any new power?—The grant of Henry the fourth was confirmed by succeeding Monarchs; the 10th of Henry the fifth, the 15th of Henry the sixth, and the 1st of Edward the fourth, confirm the grant to the men of Gravesend; and then in the reign of Elizabeth the same persons were incorporated for the first time. The charter of Elizabeth recited the previous letters patent, confirmed them, and directed that they should be governed by the corporation. The charter of Charles followed, and confirmed all that had preceded; and in the various Acts of Parliament relating to boats, particularly those relating to the Watermen's Company, I believe the rights of the inhabitants of Gravesend have been preserved. In point of fact it has been a duty with the inhabitants of Gravesend to provide that the city of London should not succeed in violation of their charter.

1520. Have the corporation, in pursuance of these charters, made bye-laws for the government of the Ferry?—They have.

1521. When was the last bye-law?—The last bye-law for the regulation of the Long Ferry was in 1692.

1522. And when they were revived in 1824, that was not interfered with?—We did not in 1824 interfere with the laws for the management of the Ferry, for this particular reason, that steam was considered then in an infant state, and the acquisition of it was looked upon as so important to Gravesend, that the corporation considered themselves not justified in making laws then, until experience should show them what was the best course to take; and our laws required the consent of our lord high steward, the Earl Darnley; and it was thought best that such laws should not be interfered with at that period.

1523. You consider that you were not authorized, in consequence of your inexperience at that time, to change the laws?—Yes, we did not think it prudent to interfere at that time with steam-packets.

1524. All your charters depend upon that of 1401?—Upon the ancient usage, confirmed by the grant of 1401.

1525. They are mere confirmations of 1401?—Yes.

1526. And that gave you a certain monopoly on your taking the fees of the ferry; do you do so?—The fees are varied from time to time as the value of money.

1527. Do you take the same fees as formerly?—I cannot say whether they are in the same relative value. I am not aware of any specific sum.

1528. You observe here the words, "the fees heretofore used;" do you believe that you now take the fees heretofore used before the year 1401. What fees do you take?—The fare to Gravesend from London is 1*s*. and 1*s*. 6*d*.

1529. Did you ever know that they have differed?—They have differed within the present year.

1530. You have mentioned the Long Ferry, that is the passage from London to Gravesend?—Yes.

1531. What is your first set of regulations, as regards the Long Ferry; your passage from Gravesend to London?—I find we have regulations made for the government of the Long Ferry in the 37th year of Queen Elizabeth, 1596; and those regulations were made in concurrence with the city of London. The city of London having from time to time claimed a right to the ferry from London to Gravesend, we only claim the ferry from Gravesend to London, and not both ways.

1532. As a professional man, do you conceive that any charter from the Crown, which is contrary to the common-law right of the subject, is valid?—Certainly not.

1533. Do you conceive it the common-law right of the subjects to go or return from any place as they shall think fit?—I believe to be part of the common law any ancient usage from the memory of man.

1534. Have you any bye-law not embodied in any Act of Parliament relating to the number of passengers to be carried in your boats?—I believe there is a bye-

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law or some reference to the numbers to be carried in the ancient passage-boats from Gravesend to London.

1535. In any other direction?—No; I can speak only with reference to the ferry.

1536. Have you any Act of Parliament upon the subject, of the reign of George the second?—I have not here.

1537. Do you know of any?—Not at this moment.

1538. The Act of Parliament that was passed respecting the river between Gravesend and Windsor, in which it is stated, that “if any waterman receives into his boat or barge a greater number of persons than the Act allows, in case any person shall be drowned, such a person is guilty, not of manslaughter, but of murder,” have you that?—I have not it here. I believe a reservation of the rights of the inhabitants of Gravesend will be found in that Act; and it will appear that the Watermen’s Company are not to license any boat belonging to the town of Gravesend without the previous license of the corporation of Gravesend.

1539. Are you aware of the Act of Parliament alluded to?—I am aware of it now.

1540. Is there in it a reservation of the rights of the inhabitants of Gravesend?—I think so.

1541. If you are not aware of the Act, how can you be aware of the reservation?—Because I believe that in every Act of Parliament, from the time of William and Mary, a reservation of the rights of the inhabitants of Gravesend will be found.

1542. Have there ever been any prosecutions for carrying an improper number on board your boats from Gravesend?—I believe not.

1543. Do not the boatmen frequently do it to your knowledge?—I am not prepared to say that. I am in the constant habit of going to and from London in the steam-boats; not on a Sunday, when they are most crowded; but on the occasions to which I allude, I do not remember that I can call to mind any one time when steam-boats have been more loaded than they might be with safety.

1544. They have made no regulations with respect to steam-boats?—No, they have not. May I be excused for stating, that during the whole time that steam-boats have been introduced upon the Long Ferry from Gravesend to London, under the control of the corporation, no accident of any kind has occurred, with the exception of a little damage done to some barge, but no loss of life or limb has arisen from those boats, nor have they been charged with that; which I attribute to the superior management of those vessels, and to the extraordinary care which the masters of those vessels, who take out licenses from the corporation, take of them.

1545. Will you explain the description of license which those captains get?—The license is an annual license, and it states that the court have examined the captain as to his capability to be master or steersman of the vessel; and if they find him to be competent they license him for one year, unless any complaint is made against him.

1546. Is any reference made to the description of boat or the efficiency of the boat he has to command, before a license is granted?—I should explain that those licenses have never been granted to the steam packets, for the reasons I have before mentioned, with one exception: the *Sophia Jane* had a license granted. When the parties for the old sailing vessels applied for a license, they were within the knowledge of the court, the boats as well as the persons; and therefore it was a matter of notoriety whether the boat was good or bad, and whether the master was a discreet and sober man or not.

1547. Supposing such an event had happened, that a man well known to you had appeared before that court and had asked to be licensed for a boat, which boat had not been known to that court, would the court have deemed it necessary to make any inquiries respecting that boat?—Assuredly.

1548. You say that there is but one instance in which a license has been granted to a steam-boat; will you state how that was?—Steam vessels were first brought to Gravesend from London by London builders and speculators. The corporation did not, as I have before stated, interfere; but such vessels were very inadequate to the increased resort to Gravesend; they were very slow, frequently upon an ebb tide occupying as much as five hours and a half or six hours. Great complaint was made to the corporation of such tedious ferry. The corporation remonstrated with the owners of the boats, and they did not receive a satisfactory answer, and therefore

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therefore they induced other persons having better packets to come to Gravesend. Those persons were owners of the vessel called the *Sophia Jane*. That packet was much quicker, performing the voyage in three hours, and against the tide in four hours; the inhabitants then built boats of their own, to supply the place of the sailing boats belonging to the town. When the *Sophia Jane* came to Gravesend, the captain applied for a licence, and the corporation granted it of course, knowing first that the captain was a fit man, he having been a lieutenant in the Navy, and knowing also that the boat was a good boat, from her character for running.

1549. It would appear then that the first steam-boat that came to you was licensed, and afterwards a great many were built?—Three were built.

1550. And no notice taken of them, and no licence applied for?—No. I myself intimated to the managers of those boats that they would be called upon by the corporation to take out a licence.

1551. What did they say upon that?—It was not followed up.

1552. Can you account for it being neglected?—Only from the corporation not being desirous to take it up hastily.

1553. Is there any fee paid on taking a licence?—A fee to the clerk of a guinea.

1554. How many are there running between London and Gravesend now?—There are three packets belonging to the inhabitants; and the number resorting to Gravesend depends upon the state of the season, and the time of the year; in a good season I have known seven packets come from London in one morning, and three more in the afternoon.

1555. And the *Sophia Jane* is the only one that has been licensed?—Yes. The corporation have not interfered, considering that the time would arrive when some enactment would be made. We have always looked forward to some regulation of steam vessels; and we have waited till that time arrived.

1556. You say that the Long Ferry applicable to Gravesend is only to London; supposing a vessel going to Gravesend, on her return is she under the jurisdiction of the city of London?—I do not know what jurisdiction she is under; we claim jurisdiction over our own steam packets coming down; we have no right to interfere with other vessels coming down.

1557. You possess absolute jurisdiction over vessels coming from Gravesend?—Yes.

1558. They cannot increase their number without your consent?—No.

1559. With respect to this Act of the 10th of George the second, have you ever heard of it as town clerk?—Yes, certainly, it is repealed. I ought to have stated that we continue to pay to the Crown, and have ever done, a fee-farm rent in respect of this ferry. I hold now in my hand a receipt of 1830: "Received of the corporation of Gravesend and Milton, Kent, the sum of eleven shillings and eightpence, being one year's fee-farm rent, due at Michaelmas 1830, for their charter and long ferry to London." Signed by William Reeves.

1560. Is that one of the provisions of the first charter which has been read, that you shall pay a certain sum to the Crown?—No, I believe not.

1561. Where do you first find that you are to pay that fee?—It is found in the corporation books, in the time of Charles, I believe. I cannot speak with confidence prior to that; but we have authority to show the payment of it from the time of Charles, if not prior.

1562. Is it mentioned in Charles's charter?—Yes, it is "paying for it yearly to us, our heirs, and successors, 6s. 8d. good and lawful money."

1563. Does that charter recite all the former charters, and confirm them?—It recites the charter of Elizabeth; it does not recite all the former charters.

1564. Does that charter of Elizabeth recite all the other charters, and confirm them?—Yes, it does.

1565. It would appear, that you have not yourselves kept to the condition of your charter, because, if the first granted charter gave it to you on condition that you should always receive the same fee, and only the same fee, on your passage, and you are always varying that, you must have departed from your own charter?—The corporation have never recognized any deviation from it: "Taking the fees as accustomed," the words are.

1566. Is that a correct translation of the charter?—I believe it to be, I had it from the Tower.

1567. Are the same words noticed in all the successive charters?—In the 10th

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and 15th of Henry, and the 1st of Edward, the same words are used until you come to Elizabeth.

1568. Have you anything more to offer to the Committee?—Nothing further than to state, from frequent observation, that I consider the great danger in the Pool arises from the daring conduct of the watermen. The small craft is so very light and shallow, as not to be calculated to approach a steam-boat when under weigh; I mean those boats immediately below London Bridge; they are very different in the town of Gravesend, there they are large and capacious, although not licensed to carry more than the others.

1569. If a steam-boat was going only four or five miles an hour, would she endanger boats?—I think she would, some boats.

1570. Would she make a sea?—No sea, there would be a ripple enough to make one of those small boats not safe with eight persons in her.

1571. Those small wherries that you speak of are not allowed to carry eight?—I am speaking of the large class of wherries that are licensed to carry eight, large as compared with the others, though they are so small as, in my judgment, to be almost unsafe in smooth water, and certainly unsafe when approaching a steam vessel.

1572. How is the case with regard to sailing vessels; have they evinced that sort of conduct?—The sailing vessels from Gravesend have ever gone to a wharf and landed their passengers, without the use of small boats; they have gone by Billingsgate since the creation of the charter.

1573. If the Committee understand you right, it is your opinion that all the wherries that are accustomed to carry eight persons on the Thames should either be put aside and be prevented going on the river, or that steam-boats under any restriction whatever should not go beyond Blackwall; that is to say, the largest wherry on the river cannot pass with safety a steam vessel in the Pool, however much you restrict the velocity of the steam vessels?—I mean in that part of the river above Limehouse: the boats are not sufficiently safe.

1574. If that be correct, must not this conclusion be derived, that it would be absolutely necessary either to prevent any of His Majesty's subjects going on the Thames in those wherries at present constructed, or to stop the steam-boats at Blackwall?—Yes; I think the wherries have not been improved to meet the improved navigation of the river.

1575. If they were made as you recommend they would not go so quick?—Not so quick.

1576. Would they do to navigate the Thames?—With submission, I think they would.

Mr. William Fletcher, called in; and Examined.

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1577. WHERE do you live?—At Milton, near Gravesend.

1578. Are you an Alderman of the Corporation of Gravesend?—I am not.

1579. Do you know much of the water?—I was bound to my mother at 14 years old, and have followed that occupation ever since; I am now 57 years.

1580. Can you speak to the management of the steam-boats belonging to Gravesend?—Yes.

1581. With reference to the precaution used by the corporation, and the necessity for that precaution, and the necessity of a large discretion being used?—We have used great caution in selecting men for navigating our ships: our men, every one of them, are free watermen; there is in the Essex, five; in the Kent, six; and in the Pearl, five, who have been masters of sailing vessels previous to being employed in steam packets.

1582. That is proved by a fact of there having been no accident which occasioned loss of life from any of the Gravesend boats?—Never, I am sure of it.

1583. Are you aware of a petition that was sent to Parliament in the month of August last?—I signed it, and brought it to London. I was instrumental in its being got up.

1584. In that petition was it stated that the inhabitants of Gravesend, and those interested in steam navigation, would gratefully receive from the House of Parliament any measure to improve steam navigation?—Yes, I perfectly recollect it was so expressed.

1585. And you concur in that?—I do, as far as the measure does not restrict us to too slow a pace in the Pool, if we go in a navigable way.

1586. You

1586. You objected to the provisions of a Bill, at that time before the House, limiting the speed to six miles an hour?—I object to it against the tide in particular; I have been on board a Berwick smack at seven miles an hour; a Margate and Gravesend sailing packet would exceed seven miles occasionally, particularly when the wind comes abaft; and I have myself gone up the Pool in a very short time, as fast as ever a steam-boat comes now I think I have come.

1587. In that petition it was stated, "That the crowded state of the Pool, and the cross setts of the tide, render it frequently necessary that a steam vessel, in order to avoid receiving damage or doing it to others, should be at liberty quickly to alter its position, by advancing or retiring at its greatest power of speed; and that if this discretion (liable as it is to legal responsibility whenever abused) is not continued to the person navigating the vessel, the most dangerous consequences will frequently ensue;" is that your opinion?—That is my opinion; I was particular in getting that into the petition.

1588. It is also stated in that petition, "That your petitioners' steam vessels pass to and from Gravesend and London twice every day; and during the many years they have run, have never occasioned, nor been charged with having occasioned the loss of life?"—That is confined to the Gravesend boats; they have run not quite three years.

1589. It is also stated there, "That the London wherries are occasionally endangered by the circumstance of their owners using them to ply passengers by steam vessels when under way, for which they never were intended; and by reason of their being so very small and shallow, that they are only safe in smooth water;" is that your opinion?—It is. The last time but one I came up (at the Old Swan, I think it was,) about three weeks back, I embarked, and I complained to the waterman there into whose boat I got, and told him that the rulers of their company ought to be ashamed to license those boats for eight passengers; I said, "yours is one of the smallest class of wherries I have ever seen." I had no rule with me, but I measured the water on both sides, and to the best of my judgment, it was only four inches and a half above the water, with two persons in her, the other person and myself weighing about 30 stone.

1590. You saw that the boat was licensed to carry eight persons?—Yes, it was written upon the back-board. The waterman said that he had got a larger boat, but if he used it he could not get a living by it; and he said he got more by letting his boat out to young Bucks, as his expression was, than he got by it himself.

1591. Have you the name or the number of the boat?—No.

1592. Did you understand that this boat was one that he had put in the room of the larger one that he had?—I do not know; I did ask him whether he belonged to the Company, and he told me he did; and I said I should complain to Mr. Drinkall of the Watermen's Company about it.

1593. Did you ever make any complaint to the Watermen's Company?—No; I spoke to Mr. Drinkall about it in conversation.

1594. Was it painted?—Painted on the back-board.

1595. In the usual way?—In the usual way, agreeably to Act of Parliament.

1596. Could that have been a false back board; might it have been taken from the other boat?—I do not know, it fitted the boat.

1597. Was it painted in the same way as the boat?—Yes; I believe it to be the back-board of the boat I was in.

1598. Is that a single instance?—No; I think I could find now 20 wherries licensed for eight, not capable of carrying six.

1599. Have you any doubt of the fact?—None at all.

1600. He owned that it was an exception?—He owned that he had a bigger boat, but he said that the gentlemen would not like to go in that against tide.

1601. With respect to the possibility of the back-board not belonging to that boat, if it belonged to a larger boat, would it fit a smaller one?—It might; a boat of more width might be able to carry the same back-board. He stated that he made more money by letting her to young bucks, than running her himself. When I have come up in our steam-boat, at the time we used to stop at the Custom-house, I have stood at the gangway, and I have told the gentlemen, when I have seen a boat of that kind lying alongside, they should not go into that boat, as it was our duty to prevent accidents; and the watermen have said, I shall not get my fare; but I have prevented the gentlemen from going into those boats.

1602. The next allegation in the petition is, "That at Gravesend, and all other places where steam vessels resort, excepting only London, plying boats are

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properly adapted to an agitated state of the water; whereas in London, a wherry capable of supporting not more than half a ton weight is licensed to carry as many passengers as a Gravesend boat, which can support two tons;” is that true?—That is true. I do not think that the wherry that I am speaking of would carry half a ton, and the waterman said he would not be afraid of taking half a ton in her; and I said, Then you must put it afore and abaft; and he said, Yes, he would; and I told him he could not carry passengers in that way.

1603. The next allegation is, “That the alleged injury to open barges and craft arises principally by the fact of their notoriously overloading, and the improper manner in which they take in their cargoes in the river, especially coal barges, to avoid the trouble of trimming;” what is the meaning of that term?—The term the bargemen make use of is siding their coals; I believe it is a general term amongst bargemen; they put the barge alongside the ship, and to save the trouble of trimming, they shoot the half of the cargo into one side, till I have seen the water rippling on the gunwale of the barge; then the barge is turned round to the other side, and they shoot the other half in there, and it requires very little trimming to fill the middle up.

1604. You object to that?—Certainly. Any sailing vessel or anything else coming along will cause the water to run into the barge. I have, in coming along in my sailing boat, caused the water to run into a barge many times.

1605. Did you ever produce any inconvenience by your vessel to the effect of sinking a barge?—I never saw it amount to more than chucking 500 weight of water into a barge deep loaded.

1606. Supposing barges were not to load so much, you say that that would get rid of the difficulty, but would it not be a loss to the owner of that barge?—I think that, like other vessels, they ought to load so as to be safe.

1607. If you were the owner of that craft, should you not consider that it would be a loss to you?—It would, if I had to employ another man and barge.

1608. In loading craft you are anxious to put in as much as you can?—Yes, I have loaded very deep.

1609. The last allegation is, “That if the Court of Aldermen of the City of London would enforce their bye-laws made for the regulation of watermen, under the authority of the Watermen’s Act, and if only such boats as are adapted to the improved state of commerce and science were permitted to be used below London Bridge, and if ships and barges were properly moored, the alleged danger to the public would be principally, if not entirely, removed;” is that your opinion?—My opinion is, that there are frequently four or six ships in a tier more than there ought to be, where another tier has plenty of room. They are not regularly moored, I think, particularly about Hanover Hole, and opposite Globe Stairs, up to the large corn granary.

1610. Is it your opinion that if the provisions of the Watermen’s Act were duly enforced by the Court of Aldermen, it would supersede the necessity of almost any other regulation upon the subject?—I have had a little conversation with Mr. Drinkall, and he said “that the watermen would be starved with such boats, for nobody would go in them.” I say that no wherries ought to be less than the Greenwich wherries.

1611. Do you suppose that it would have that effect upon the watermen if it were universal?—He would have to pull the harder against tide, and go slower.

1612. Is there any part of the regulation of the Court of Aldermen that you think is rendered necessary by the action of the steam vessels?—They have a law, but I do not know how it is enforced; the boats are to have a certain width, and then they say that the wherry is to be such a depth, at the third streak up. Old wherries have been built, and I have seen many with seven streaks. But to evade that, they have broader streaks at the bottom; and the wherries are now many of them built with not more than five streaks; six, I believe, is the most they have.

1613. Then you think that wherries are less safe than formerly?—They certainly are. Astley’s wherries, prize wherries, being so small have done great harm; she is won by a powerful man, and others to compete with him have also had very small boats built.

1614. You have expressed an opinion, that if the bye-law of the Court of Aldermen were enforced, that would have that effect?—I am not sure what that alludes to; of course to the size of the wherries.

1615. Do you adhere to the opinion expressed in the petition, that some regulation of steam vessels would be a general benefit?—I do. I should be at a loss if I were asked to recommend what that should be.

1616. The

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1616. The Committee understand you to contend in that petition, that if the regulations of the Court of Aldermen were complied with, it would be sufficient. With respect to one of those regulations, which is, that the steam vessels going through the Pool should not go faster than five miles an hour, in your opinion would the steam vessels comply with that?—At certain times of the strong ebb the tide will run nearly five miles, and therefore she might as well be made fast as go at that speed.

1617. Have you ever proved that fact?—No; but I know in what little time I have gone from Billingsgate to Wapping Point; I have rowed down in nine minutes, at that particular time when the tide first comes off the starlings.

1618. You do not apprehend that the fair tideway ever runs at that rate?—I think the fair tideway runs four; say the tide is flowing at three o'clock.

1619. Do you think every spring would run four?—I think it would run four at about half-past four o'clock to-day.

1620. What is the distance from the entrance of the Pool to the point where steam-boats land?—I never tried it, but I should think it cannot be less than three miles.

1621. If you allowed her to go six knots at that particular time of the tide, she would only be an hour and a quarter?—Yes, calculating that there is no vessel in the Pool to obstruct us, because sometimes we are obliged, in coming up the Pool, to turn astern, which delays us some time.

1622. How long do you allow your boat to be in coming against the tide from Gravesend to Cuckold's Point, with her full power?—Three hours and a quarter, unless she had a great many passengers; that would make a great deal of difference; three hours and a half.

1623. If she came with the tide, how much would you give her?—Two hours and ten minutes, or two hours and a quarter, with the tide; but floods vary as well as ebbs, and wind ahead will make 10 minutes difference. We never go faster than in a calm.

1624. In a calm, with a strong flood tide, you would get as far as Cuckold's Point in two hours and ten minutes?—Yes.

1625. Upon the average, should you have the tide against you all the way, starting against tide?—If we go two hours after high water, I always calculate the boats will do it in four hours.

1626. Then you take the whole of the tide against you?—We should be up about two hours before the ebb is done running.

1627. But it would begin to get slack?—It begins to slack as we get along, and we do not loose so much ground in crossing when the tide begins to slack, we make it a nearer road.

1628. If you started at Gravesend two hours after high water, at the time you got to Cuckold's Point would you not have a perfect command of the vessel?—We should be going three hours and a half; but it is rare that we come up without stoppages; in the case of ships dropping into the Pool, it is necessary that we should go into the bows of a tier, and without great speed we cannot get out again.

1629. You say that if you have not greater speed at times, you are liable to be in great danger; but at present are not sailing vessels, in moderate wind, and rowing vessels, in that predicament which you object to?—Exactly so.

1630. If they see a vessel coming along so as to require that they should use that speed to carry them ahead of danger, do not they back out of it?—They frequently let go their anchor; but in a large vessel that is very dangerous.

1631. And if it is a boat she backs?—Yes.

1632. Then the only inconvenience to a steam-boat from not having greater speed, would be to oblige her to do the same, to stop, or to drop her anchor?—Yes; but then our boats are the length of a 74-gun ship, the length of the Kent is 121 feet 4 inches.

1633. You are accustomed to those steam vessels; how soon can you stop that vessel quite dead?—I think in about three times her length.

1634. How soon can you stop her way?—Directly the master calls "Stop the engine," and the paddles are stopped, and they are then like a waterman pushing back with his oars, and then we say, turn astern.

1635. And she goes back very soon?—Very soon.

1636. Therefore, in spite of her length, you will get her very soon out of that danger, and instead of pushing her along, you could soon have her going astern?—It is an every day's business with us.

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1637. As those wherries are now constructed that navigate the Pool, if they come near a steam-boat with her full way, are they not in considerable danger?—I think they are; such wherries as are now constructed would be in great danger with a steam-boat going 10 miles an hour.

1638. If a steam-boat reduces her speed to go at the rate of about six miles an hour, is that swell much diminished?—I think neither of our boats make much swell at seven miles an hour.

1639. From what part does your swell proceed, from the paddle-wheel or the bows?—From the bows; the paddle-wheels only obstruct their own gangway.

1640. Do you believe that the danger would be proportionally decreased by an additional safety in the vessel and capacity in the size of the boats?—I would not hesitate to go in one of our Gravesend boats, on board a Margate steam packet when she was going 13 miles an hour.

1641. Do you think that the boats might be so made as to obviate the danger?—Yes; they must be boats to be worked by one man; the Greenwhich are worked by one man, and they are very good boats; they are not afraid to board us; we only say, ease; we do not slack our way, unless we see it is a small boat.

1642. Is there any regulation upon the subject?—There is a person, a beadle of the company, four at Gravesend, to take care that only two go along-side at the same time; the boats go near enough to touch one another, though they say they are not along-side.

1643. Have you ever seen any danger arising from it?—I never saw but one; I saw one man get overboard, but it was his own fault, he got under the paddle-wheel, but he swam out; he was a very good swimmer.

1644. You spoke of a difference between the former boats and the present; that the former boats were much safer than the present. If there was any regulation to make the present boats of the same capacity as the former ones, would there be any danger?—Not if the boats have proper bottoms; if she has not a proper bottom she is not a safe boat.

1645. Do not you think that the Pool has been better regulated within the last four or five years than it used to be?—Yes; but the docks take one third of the ships that used to be in the Pool; there is generally about 300 sail of shipping in the docks.

1646. Then you attribute the improvement rather to the docks taking in the ships, than to the enforcing of the regulations which have been made?—If there were no docks made, there would be more ships in the Pool; nearly all the West India ships used to lie in the Pool.

1647. Do you not know that there was some stir made in this business by the City, and that there were some regulations made, which have been enforced since?—I know that the harbour-masters frequently stop a number of ships coming in, and they have moved a ship which has been moored; but I only know of one instance of that kind.

1648. In point of fact, has there not been an improvement in the mooring of vessels?—Yes; but I frequently see a ship moored outside a tier, when the next tier has room for four or five ships.

1649. How many steam vessels belong to your company?—Three; the Kent, the Essex, and the Pearl.

1650. Have you seen the harbour-masters endeavouring to regulate the vessels in the river?—I frequently see them going on board of the ships, and speaking to them.

1651. Do they not make ships go to their proper moorings?—They do, sometimes; but I think if they were more severe, and gave them the trouble of moving when they moored in a wrong position, they would have more effect.

1652. You are a proprietor of steam-boats?—I am.

1653. Have you ever had an action brought against you for damages which you have done?—No; we have been once or twice threatened.

1654. Have all the accidents that have occurred with your boats occurred from the carelessness of the captain, and not from the use of steam?—I do not know that it is carelessness; it is unavoidable. I have had accidents of the same kind myself, when master of my own vessel, and I am sure I could not avoid them.

1655. Do you consider that the chance of accidents is greatly increased by the use of steam?—Yes, in some cases.

1656. Under the present system should an accident occur from a steam vessel, it would be necessary for the person injured to bring an action; should you object to

to a summary power to a certain extent being given to the magistrates for awarding compensation for injury done?—If it was proved to be the captain's wilful misconduct, he ought to be subject to punishment.

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1657. Do you not think that such summary power would lead the captains to be more careful than they are?—I do not think they can be more than they are; they are very careful in passing us. I do not know that I ever saw them passing us at an improper speed, and they never pass us at less speed than they are going, about eight or nine miles an hour.

1658. You never saw any racing?—We both go as fast as we can below Blackwall; we tell the engineers to drive them as fast as they can.

1659. What was the result of those applications that you had?—We had a call made upon us for the damage done by our ships; and we generally ask the master whether it was his own fault, and if he says that it was his own fault, we send or attend to it; and we have no law; we go and settle it as soon as we can.

1660. Do the proprietors, when they have to pay damage of that kind, inquire whether it is the fault of the captain?—We first of all ask the captain; and if he says that it was accidental, then we ask the mate, or some person on board, if he could have avoided it, and if we find that he could not we pay the sum.

1661. Do you mean that accidental injuries could not be avoided by greater precautions?—That Pool is not to be navigated without accidents. I know I never did it wilfully in my own vessel. I have broken bowsprits, booms and masts in my own vessels, and so on, which I would not have done if I could have helped it. We have so much confidence in our men that I think they do it accidentally.

Mr. Robert Pearce Cruden, again called in; and Examined.

1662. STATE to the Committee your answer to the alleged discrepancy between the ancient and the present fees?—It having been stated that we have not conformed to the original condition of our ferry, I take the liberty of observing, that it will be found in the Pleas of the Crown, that the men of Gravesend were presented to the justices itinerant, for charging a penny instead of a halfpenny. I submit that the corporation of Gravesend would not be able to maintain a ferry if they were to charge merely a penny now. We therefore take the words referred to, "That which will sustain the ferry," but I would submit that the fares now are under an Act of Parliament, and it arises in this way: We have found that the freemen of the Watermen's Company are the most competent to navigate boats in the river, and therefore, when laws have been enacted to regulate these men, we have been assenting parties, thinking it contributory to the execution of our duty to the public; we always having preserved in those acts the original authority of the corporation; that has arisen from the watermen being such competent men. Again, some inconsistency might appear in our assenting to the application of the watermen's regulations in that ferry, but they being the most experienced persons, and we reserving our ancient right have assented. We have had in contemplation to introduce, or at least to make some solicitation for further authority, with the concurrence of the city of London, and our great desire is, under the authority we claim, always to employ the watermen free of the company, because they are the most eligible persons; and, in point of fact, the boats are navigated by men entirely free of the company. I may add, that the women employed as cabin attendants are, two of them, the widows of free watermen, and one of them the wife of a free waterman. We consider that we have done justice in the management as long as we have kept up this ferry.

Mr. R. P. Cruden.

1663. In what year was this plea of the Crown?—About the 19th of Edward the first; we take that fact as historical evidence of our legal grant, because that was in 1291, and comes in to show that there was a ferry between Gravesend and London at that time.

1664. And that the corporation of Gravesend did at that time try to raise their fares?—The men of Gravesend. The 10th of George the second is an Act for regulating the Watermen's Company, and there is almost a similar Act of the 34th of George the third; both those Acts restrict the number to be carried in sailing boats to 37, and I have frequently seen them take 120; and that is what I meant when I stated to the Committee, that a law restricting the number would, in practice, I think, be evaded.

1665. The whole of the people you now employ are free of the Watermen's Company?—They are; I have confined myself to the boats of Gravesend.

Mr. *William Fearnall*, called in; and Examined.

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1666. YOU are a ship-builder?—Yes, in partnership with Joseph Fletcher.

1667. Where do you reside?—At Limehouse.

1668. Have you built any steam vessels?—We have built eight since the year 1826.

1669. Were they steam-boats of the largest class?—We built two that are employed between Dublin and London; the Shannon and Thames, of about 513 tons.

1670. Have you formed any notions as to what would be the proper scantling, according to the size of a steam-boat, in order to secure her?—We exercise our judgment as to the nature of the service she is to be employed in. If it is to be a sea-going vessel, we proportion the scantling accordingly, and build them stronger than for a river-going vessel.

1671. All vessels that are liable to the sea must be of a certain strength, must not they?—They must be strong enough to resist their running on the ground. The Shannon has been several times on shore, and she has beaten so heavily on the ground as to throw people down on the deck, without doing any essential injury to the ship. She has proved to be strong enough to resist beating on the ground with a heavy cargo on board.

1672. Have you examined yourself the Shannon after an accident of that sort?—After she beat over the Spaniard, and it was apprehended that she might have got mischief, I recommended the directors to put her into dock to examine her bottom, because if any accident had occurred afterwards, and she had not been examined, the underwriters would have been justified in not paying for damage she might have afterwards received; and when she was put into dock, we found the plank of the bottom nearly rubbed through in several places, but the timbers were not all injured, nor did the vessel exhibit any symptoms of weakness; she did not require any repairs in consequence, except the damaged plank, which we took out, and renewed it.

1673. Do you consider that you have made that vessel stronger, and consequently more expensive, than is really necessary for a passage vessel between London and Ireland?—I really consider that a steam-boat cannot be made too strong to resist the different circumstances under which they may meet with misfortune.

1674. Do you consider that a vessel would be sufficiently safe for carrying passengers, if built as strong as this one to which you allude, the Shannon?—If we had another sea-going vessel to build, we should build it equal in strength to the Shannon and the Thames, and of the same scantling; and we should be rather apprehensive if we reduced the scantling very much, that instead of beating safely over a shoal, she might remain there.

1675. You would not think it necessary to build any steam vessel at all stronger?—We think the Shannon is strong enough to go to India, or any part of the world.

1676. You would not think it right for anybody to build a vessel to go into the great sea, and liable to meet banks, exposed to an open sea, of slighter scantling than the Shannon?—We should not approve of building one slighter than the Shannon; and we believe the Shannon has been proved to be strong enough.

1677. Will you have the goodness to state the size of the scantling of the ship?—I cannot do that from recollection; but I will send the Committee a scheme of the scantling.

1678. What is the tonnage?—513; about 513 tons.

1679. If you were to build a smaller vessel, a vessel of 300 tons, for going to sea, in what proportion would you reduce the scantling?—We should certainly make a reduction of the scantling for each sized vessel; and I will send to the Committee a scheme of scantling for each vessel.

1680. A vessel of that description would be of sufficient power to stand the common accident of getting ashore in a sea-way?—Yes.

1681. In your opinion, how often would it be necessary to examine a steam-boat to insure that her timbers remain in a perfect and efficient state; how often do you think it would be necessary to open her linings to look at her timbers, in order to be sure that they have not become rotten?—I should imagine that it would not be necessary to incur an expensive examination oftener than once in five years; I do not think it would be necessary to examine them more frequently than that. If they were not infected with the dry rot they would run, without any danger, for that

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that time; but if it should unfortunately happen that the dry rot had commenced soon after the vessel was built, in that case examination should be made within three years from the time she was built.

1682. Do you make it a practice always to have an inside lining to steam-boats?—All the steam-boats we have built have been on the diagonal system, proposed by Sir Robert Seppings; we have followed his plan.

1683. Therefore the frame of the vessel, owing to the timbers being close, and afterwards filled in, was perfect when the planking was off?—Yes; we put fillings between the timbers to the height of the floor-head, and caulked them.

1684. Therefore, if all the planking came off she would still float?—Yes; if the caulking remained good, but she would not be very tight.

1685. But she still would float?—I think she would, if the caulking remained good; but it is done more to make a firm and solid body of timber to resist the pressure of the engines, and to resist any striking against the ground.

1686. Have you any knowledge with regard to the engines?—I do not profess to understand anything of the engines; I am a ship-builder.

1687. Have you built any steam-boats to run on the river?—We have built three for the river.

1688. You build those smaller than sea-going packets?—Yes, and of less strength.

1689. How long do you think they may run with safety?—I should think they may run with safety, without requiring any considerable repair, for about ten years. They will require caulking and painting in that time, but they will not require any considerable repair.

1690. Should you think that you gave sufficient security to the public if you obliged every steam-boat carrying passengers to the great seas to be examined, as to her sea-worthiness, once every five years, and every river steam-boat once every ten years?—I should imagine it would be necessary to examine them oftener than that. If it so happened that a vessel had got the dry rot she might become dangerous in less than five years.

1691. Will you state to the Committee how often you think it would be necessary to examine them?—I think I should be perfectly correct in stating that a sea-going vessel ought to be examined at least once a year.

1692. Do you build the steam-boats for the river in the same way as those for the sea service, filling up between their timbers?—Precisely.

1693. Have you any observations that you can favour the Committee with, that might assist them in coming to a conclusion as to any regulations that should be adopted to secure the safety of the public that go in steam-boats?—I should imagine that it would be very proper in every port where steam-boats ply, that they should be examined by the surveyor of the Customs, calling to his assistance a ship-builder and engineer, because in some parts he might not have sufficient experience without them; but if the surveyor of the Customs in every part of England was to be desired to survey the vessels, and occasionally calling to his assistance a ship-builder and a competent engineer, I should imagine that would prevent a great deal of mischief.

1694. Would that be effectual without stripping the ship?—It would be effectual if the ships were laid on shore upon a bank, or put into a dry dock, to be examined; and where they are not built diagonally, that some planks should be taken off inside to examine the timbers. Where they are built diagonally, it is not necessary to take off any plank, because the timbers can be seen, and are less liable to rot, because they are exposed to the air.

1695. Will you have the goodness to state to the Committee what, in your opinion, would be the average expense to the owner of such steam-boat if he was obliged to have his vessel so examined, and that repeated every year, if the vessel required no repair; if the surveyor merely examined the inside planking in three or four places to satisfy himself that the timbers were good, and gave such an examination outside as he might think necessary, and taking his own fee for it, what would be the whole expense, taking into calculation the expense also of the caulkers?—I should imagine that the fee paid for the survey, perhaps a ship-builder being called in, with taking the plank up and putting it down again, would amount to about 15 l.

1696. Do you think that would be the charge if a man had to survey every steam-boat?—If a man was appointed to make a survey of all the steam vessels in London, in all possibility he would be satisfied in charging a fee of two guineas. The expense of taking up the plank would be a charge made by the builder, and very likely

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that would amount to 12*l.* more. It would be better to over-rate the expense than under-rate it, because there might be other circumstances which would happen to affect the expense.

1697. In how many places would you think it right, before you considered a vessel sea-worthy, to open her inside?—I think it would be necessary to examine a vessel as near the middle line of the floors as possible, in order to ascertain whether any of them were broken; to do the same above the floor head, to see whether any of the futtocks were broken, and at the ends of the beams and clamp, to ascertain if dry rot had commenced. I should imagine that that would be all that would be necessary to ascertain the state of the vessel's frame.

1698. Would not you think it necessary to look at the inside of the vessel to see whether she had the dry rot?—Yes; dry rot will sometimes take place where there is a want of circulation of air; it frequently first makes its appearance at the ends of the beams and clamp, under the deck.

1699. Would you be satisfied in looking at those points?—Yes. In examining a ship you cannot be too careful, in order to find whether dry rot has made any progress.

1700. In making a regulation to secure the public, it would be necessary to provide against the possibilities of unforeseen accidents; should you not think it necessary in order to ensure that a vessel has none of those defects, to examine her inside?—Having examined and ascertained that the floors and futtocks are not broken, in order to ascertain whether a vessel has the dry rot or not, it may be necessary to take out a plank from either withoutside or withinside, fore and aft, and then you enter into a thorough examination of the ship, and discover whether it is decayed or not.

1701. Having come to that understanding, what do you think would be the expense?—I should rather that the expense should stand in the first sum that I have mentioned, of 15*l.*

1702. Would you suggest that this survey should take place on all vessels, whatever their age might be?—It would not be necessary, certainly, to examine a ship that you know to be only one year old. It might not be necessary to examine a ship that you know to be two years old; but I think it would be necessary to examine a ship three years old, to see if there was any dry rot about her.

1703. Then you would say three years?—Yes, at the discretion of the surveyor; a ship may have some dry rot soon after she is launched; in that case it would appear at the end of three years.

1704. Then you consider that it must be left to the discretion of the person surveying?—Yes, I apprehend it must, without reference to its being done every year.

1705. Do you think that the log of a vessel might be used with reference to that, that the surveyor might be enabled to judge from that whether, such weather having been gone through, or such accidents having occurred, it would be proper, even at more frequent periods, to make this survey?—I conceive that he should have authority given him, under all circumstances and at all times, to see the log, that he might examine whether the vessel had been ashore or not, or whether she has suffered any accident from severe weather, and that he might enter into an examination of the vessel if he thought it necessary.

1706. Would it not be a safer plan if the log were laid always before the surveyor?—It would perhaps, because there would be no expense incurred by it if the log were laid before the surveyor at the end of every voyage.

1707. Have the ships made by you been wrecked?—Not one.

1708. The question does not merely refer to steam vessels?—Other damaged vessels we have had very frequently to repair.

1709. And in such vessels did you find such defect in the make that had they been better formed the amount of injury would not have been sustained?—No; I cannot say that we have met with any cases of that sort.

1710. Was the Shannon built with a shallow scantling, or with a thick scantling?—She was built with such a scantling that would have been given her had she been going to any part of the world. She is as strong as any steam vessels in His Majesty's service, and fit to go to any part of the world.

1711. Is the Shannon built stronger than the average build?—She is.

1712. What would be the increased expense in building a vessel so much stronger as the Shannon is?—Nearly 2*l.* a ton more than vessels that have been built much slighter.

1713. Did you build one of the Dublin packets that ply between Dublin and Kingston?—

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Kingston?—No. We have lately built two packets for the Post-office; one from Dover to Calais, and the other from Weymouth to Guernsey.

1714. In proportion to the size are they as strong?—In proportion to the size they are as strong.

1715. Have you built any packets for the Irish station?—Not any.

1716. What is the length of the Shannon and Thames?—About 151 feet between the perpendiculars.

1717. You have stated that you would be able to furnish the Committee with the scale of scantling. Are there not three modes in which steam-boats are built: there is one of the open diagonal, according to Sir Robert Seppings's plan; there is one built with a diagonal plank in one direction, with a close framing; and there is another longitudinally in the old way; is not that the fact?—There are those three modes.

1718. What do you consider the different merits of those three modes in point of strength?—I consider the diagonal system of Sir Robert Seppings is very good; and it exposes the timber to a constant circulation of air, and they can be examined at any time without the expense of taking off the plank.

1719. You consider the planking diagonally with iron the second mode?—Yes; and the other the third mode.

1720. Then if you were to give the Committee a scale of the scantling, would it not be necessary to consider the three different modes by which you might line the vessel?—Yes, it might be necessary that there should be a little variation in the scantling; but in the diagonal open system we are accustomed to put diagonal plates of iron, let into the timbers, and bolted through the bottom.

1721. Then to enable the Committee to be certain of the scale of scantling, would it not be necessary for you to furnish the different scantlings, in proportion to the difference of lining?—It might be necessary, but it is a thing of little importance. If I gave the Committee the scantling of the frame, and the thickness of the plank, I think that would be quite sufficient.

1722. If you line them in the old-fashioned way, longitudinally, should you not require larger scantling?—No; the scantlings of the timbers would be the same.

1723. Do you consider a vessel can be so secure when she is lined fore and aft inside, as when she is lined diagonally?—No; we see that every day; they break their sheer; but those that have been built diagonally have not broken their sheer at all. I think it is of importance that it should be known that vessels ought to be built of sufficient strength to resist the ground without taking damage, because it is the practice of the day at present to get boats built by those that will build them cheapest, and not those who will build them best.

1724. Are there any steam packets, to your knowledge, now working upon the same voyage that the Shannon does, of less strength than the Shannon, built by yourself?—There are vessels running between Dublin and London, not built by us, of less strength than the Shannon.

1725. To any other place, are there any sea vessels running, of less strength, built by you?—I have not built any vessels less strong than the Shannon and Thames, except those that are employed on the river Thames.

1726. In your opinion how should the framing of the steam engine be made?—I beg to refer that question to an engineer.

1727. In your opinion should not the framing of the engine be independent of the sides of the vessel?—It has been always my opinion that the framing should be attached to the bottom of the vessel, and not to the sides. The framing of a steam vessel, the holding-down bolts, and the whole of the means of securing an engine, should be to the bottom of the vessel, and not to the sides.

1728. Do they generally put them at the sides?—No. In Liverpool and Glasgow I believe they are sometimes attached to the beams and sides as well as to the bottom; every time the vessel rolls there will be a little alteration, and consequently it follows that if the machinery is fastened to her moveable side, it must be put out of order by it.

1729. Is it not the custom with engineers to secure the machinery to the sides?—It is the custom of engineers to secure them sometimes in part to the sides, and in part to the bottom. It is more particularly necessary in men-of-war that the machinery should be secured to the bottom, because the concussion of the guns will have a tendency to derange the machinery if it should be fastened to the deck and sides of the steam vessel.

1730. How do you connect your machinery with the bottom?—By a cast iron frame

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frame to bearers of African teak, which ought to be as strong as granite itself, and therefore the timber that is sometimes used for bearers, such as fir or Quebec oak, is unfit; it should be made of the strongest timber, such as African teak: and in every case we have made them of African teak, so strong that it is impossible there could be much vibration.

1731. Do you make the floors African teak?—Many of the floors are African teak.

1732. Have you built steam-boats for Government lately?—The Flamer, of about 500 tons.

1733. This you built by contract?—That we built by contract, for the Navy Board.

1734. You built her as strong as they gave you dimensions?—She was built precisely on the plan of the Shannon and the Thames.

1735. Did her scantling exceed that of the Shannon and the Thames?—No.

1736. Where is the Flamer employed?—She is not yet prepared for service.

1737. Have you ever converted a sailing vessel into a steam vessel?—No.

1738. You have known it to be done?—I have.

1739. Is it possible to apply that principle of securing the engines at the bottom?—Yes.

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Mr. John Matthews, again called in; and Examined.

Mr. J. Matthews.

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1740. YOU are Town-clerk of Gravesend?—Yes.

1741. It having been stated to the Committee that a question was agitated before the Lord Mayor, relative to the right of the Gravesend packets to fix their own fares for passengers, and that it was decided that they were bound by the fares allowed by the Lord Mayor and Court of Aldermen; what is your opinion upon that question?—The Lord Mayor convicted upon that complaint; but the conviction was appealed against at the London Sessions, and upon the case being re-argued, the sessions decided that steam-boats did not come within the meaning of the Waterman's Act, and bye-laws made under the Waterman's Act, and consequently the conviction was quashed.

1742. Was that the case of "The Sons of Commerce" steam packet?—Yes.

1743. In the year 1828?—Yes.

1744. And about the same time did the question arise whether steam packets were not required by the Waterman's Act to be navigated by free watermen?—In September 1828 that question arose. It was a question whether the Sophia Jane steam vessel, not being navigated by a free waterman, the party so navigating was not liable to a penalty of 10*l*.

1745. What was the decision?—The magistrates took time to consider the case, and decided that the vessel did not come within the meaning of the Waterman's Act, and consequently that the information could not be sustained.

1746. And you believe that the Waterman's Act and the bye-laws made under the same, do not extend to steam vessels?—They do not extend to steam vessels. Here is a book which contains the decision at length, the judgment of Mr. Broderip.

1747. Is there any other Act for the regulation of steam-boats?—None.

1748. Nor any bye-laws nor regulations that bear upon them?—None.

1749. What a former witness, Mr. Newman, stated, that he had not the slightest doubt that steam-boats came within the Waterman's Act, and the bye-laws made under the same, in that he is mistaken?—I differ in opinion with that gentleman, for the reasons I have stated.

1750. Then common law only is open?—Common law only.

1751. It is not in the least your wish or desire to prevent proper regulations taking place by statute upon the subject?—On the contrary, we think some regulations, some legislative enactment, would be very beneficial.

Mr. Jacob Perkins, called in; and Examined.

[The Witness produced a model of the largest packet boat in America.]

1752. THE Committee wish to ask your opinion, whether the swell on the Thames, occasioned by steamers, could be materially reduced without diminishing the speed of the boats?—I have no doubt of it.

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1753. Do you think that in the means you propose, a 10 miles speed would produce less swell than is now produced in going three?—It is my full belief.

1754. You say here that the difference between swell occasioned by a steam engine, whether going with or against the tide, is more than is generally imagined?—There is no doubt of that.

1755. Is this a description of the paddle-wheel which you have mentioned in the Paper?—Certainly.

[The Witness delivered in the same, which was read.]

Appendix, No. 2.

1756. Have you turned your attention to the explosions which may take place, or have taken place, in steam-boats?—I have.

1757. Does this Paper contain your opinion upon that subject?—It does.

[The same was read.]

Appendix, No. 2.

1758. In your opinion could greater power of steam be given to steam-boats with safety?—Yes, certainly.

1759. Do you think that greater steam could be given under the discretion of the captain or engineer; a greater pressure than would be required on ordinary occasions?—No matter how much.

1760. If the vessel got on a lee-shore, and required to use extra exertion, she could use the steam with safety?—I have no doubt of it. The mode in America of getting up the steam instantly is, instead of throwing on coal we throw on rosin.

1761. Is that a method of getting up the steam quickly?—Rapidly. I have done it myself.

1762. And thereby increasing the heat of the fire?—Yes; a more rapid way of increasing the heat of the coal.

1763. Do you think that the extra power of steam would be too much for the frame of the vessel, jarring through the sea?—Certainly not.

1764. Do you think that a vessel is benefited by an increased power of steam in a heavy sea?—I think so.

1765. Will you explain why?—Because you can with safety give more power to the wheels; for if the boat is properly conducted, she will rise upon the water. You cannot give her too much power.

1766. Do you not conceive, in pitching, if she has increased power, that will be almost sufficient to carry away the wheel?—I do not think it will, if she has increased power. The power applied to a steam-boat is different from that applied to a sailing boat; here it is down, in the other it is up.

1767. Would not that have the effect of making a vessel rush through the wave instead of rising above it?—She does partially go through it instead of going quite over it.

1768. Do you think the increased power that you would apply in a sea way you could use with safety, and make her go as fast as in smooth water?—Not so fast; but much faster than we go now.

1769. Will you explain the old plan and the new plan?—This is the model of the old plan. The effect is, when the vessel strikes the water, to set the water in motion, and one paddle follows the line that has been taken by the preceding one, and of course it does not get hold of it. The difference is, that this paddle is constantly moving in new water; it overcomes *vis inertiae* without following the track of any other paddle; in this way we may find six feet much deeper than two feet, and we find that when the end wheel is immersed up to the axle, the wheel is still doing her duty, when the old is entirely neutralized.

1770. When has the paddle the greatest effect upon the water?—When it is below, because it is deeper.

1771. At what angle with the keel will that be?—Exactly at right angles.

1772. That is the best that any paddle box can have?—Certainly.

1773. This paddle feathers like an oar, but when it is lowered most it gets at right angles with the keel?—Certainly.

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1774. It enters the water and comes out like an oar?—Yes; and doing duty even at the height of the axle, when the other would be neutralized.

1775. Does the other come at right angles?—Yes; and this at a right line.

1776. Does it operate the moment it gets into the water at right angles?—Not quite; the same as a scull.

1777. If you had two wheels, you would not have them both at right angles at the same moment?—They cannot work otherwise. By changing the motion of the wheels you go astern; there is one wheel on each side, and one astern.

1778. How do you apply the power?—It is connected with a level gear; it works as sweet as any gear in the world.

1779. It would require no alteration?—No. Another thing I take the liberty of mentioning is, that it requires half the length of shaft, because the velocity is twice as great, and there is not so much resistance.

1780. You said that in the old plan of making the paddle, the wheel comes into water already in motion; but if the vessel is moving on, would she find the water disturbed?—It would not be so great; but all the water into which it moves has been set in motion. I have seen a paddle move so fast as that the boat would stop; the whole water was scooped out like a cradle.

1781. You consider that there is an absolute loss of power in the old wheel, by the quantum of force which is necessary to bring it to a vertical position in the water?—Yes, if there were no power lost there would be none to gain; it was thought that the old wheel worked without much loss, or without much gain.

1782. Is there not a double loss in the old wheel, first, by the power required to bring it to its position, in which it shall use the extreme force, and then the power to move it out of that position again?—Yes.

1783. Then you improve it in those two points?—Yes.

1784. When you compared it to sculling, did you not mean the mode in which the Chinese scull?—Yes, the scull is very large. The advantage that we have over that is, that this is a continuous scull, whereas that is not.

1785. Suppose all the ship was made in the shape of the float-board, what would be the effect of that?—The upper part would be a drag; it would not move fast enough; the other part of the paddle would cease, when it moves the same speed as the boat, if it moved further up.

1786. Have you tried many experiments on a large scale with this new paddle wheel?—Not on a large scale; I have not had time.

1787. How long is it since you invented that wheel?—Nearly, perhaps, three years ago. My late father died insolvent, and his creditors put the patent in Chancery, and that has stopped it till now; now we are ready to go on.

1788. Does not the use of that wheel preclude your using so broad a wheel against the surface of the water?—Considerably less; it takes up much less room, because the paddles are much narrower; the diameter of this wheel will do better at eight feet than the other at 12; like the sail of a windmill, it requires a certain breadth.

1789. Would not the pressure of the shaft of that wheel be against the side of the vessel?—Yes.

1790. Would there be no disadvantage in that?—Not the least.

1791. How would you obviate the evil of the forces operating in an angular position?—There is no difficulty in that.

1792. Do you think you can state that point without experiment on a large scale?—I feel satisfied myself; but perhaps in a large vessel it might operate.

1793. Would not one wheel correct the other?—A wheel has been put in the stern without a rudder, to satisfy gentlemen that she would go straight, and she went as straight as could be required.

1794. Can you, by practical observation on the subject, give the Committee any theory as to the cause of the wave which is made by steam-boats?—I will endeavour to do it by next time.

1795. And also the different forms of steam-boats, and the peculiar effects that different paddles have in producing swell?—I will.

Mr. Thomas Lawrence, called in; and Examined.

Mr. T. Lawrence.

1796. DO you produce certain Post-office Returns, in pursuance of the order of the Committee?—I do.

1797. From what source are they made out?—From the journals of the packets, that are sent up to the Post-office daily.

1798. Were

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1798. Were the journals of each voyage accurately examined?—I think I can say that every one of them was.

1799. In the journals of the Thetis packet does there appear to have been any casualty occurring which has not been introduced into this Return?—I am quite positive as to that fact; this is an amended Return.

1800. How did it happen, that under the terms of the former order two casualties which I find here, of getting on ground, were not entered?—I believe that is explained by a letter from Sir Francis Freeling; the journals at that time certainly could not be found; they had got adrift, we could not find them.

1801. Do you find the number of casualties increased by the use of steam vessels?—Not as compared with sailing vessels.

1802. You had as large a number of casualties in the employment of sailing vessels as in the employment of steam vessels?—We have a much greater number of steam vessels employed than sailing vessels.

1803. But in the same number had you as large a number of casualties?—Yes, we had, taking them all together.

1804. Will you have the goodness to deliver in to the Committee the Returns you have now produced?—

[The Witness delivered in the same, which was read.]

Appendix, No. 3.

Lieutenant *Belson*, called in; and Examined.

1805. DO you command the *Confiance*?—I do.

Lieutenant *Belson*.

1806. How long have you commanded her?—Since the 30th of July last twelvemonth.

1807. Did you command the packet with the old wheels?—I did not; Captain Richardson did.

1808. Have you any officers that did command the old packet?—The engineer is here and the pilot also.

1809. During the time that you have commanded her have the paddles been out of repair, or the machinery?—Not in the least; they have been merely taken to pieces at the present moment, at my suggestion, in order to see that every thing was right; but they have never been touched from the time they have been put in, which is September twelvemonth; not a single thing has been done to them.

1810. Have you been much out at sea during the time?—We have. We sailed in the month of December to Malta, Gibraltar and Corfu, and I never certainly experienced such weather as we had at times.

1811. Will you have the goodness to state anything, to give the Committee an idea of the weather; did you fall in with any wrecks?—I fell in with a French corvette off Cape Valarmo, in the middle of the night, blowing very hard. I observed that she was dismasted, and immediately fired a gun. It was then blowing so hard that I could not communicate with her that night, but remained by her.

1812. Whereabouts is that cape?—The other side of Cape Finisterre.

1813. In which direction was the wind blowing?—The wind was at north-north-west.

1814. Was there a great deal of sea running at the time?—A great deal, making a fair breach over our paddle-box. I could hardly stand at the time. I remained by her that night, and the next morning at daylight I spoke her. He then asked me to remain by him, as she was in a dreadful state, dismasted and leaky, with 500 troops on board, from Guadaloupe, bound to Brest. I told him I could not remain by him, but that I would take him in tow. He then said, "Will you tow me to Corunna?" I then said, I cannot go back, but I will proceed forward with you. It then moderated during the forenoon, and I veered hawsers astern, which he caught hold of; the first time he missed them, but he caught hold of them the second time. We got them down off the rock, and it came on to blow very hard that night, and all the hawsers parted. I was then in the act of getting them off shore; it was blowing very hard when they parted. I then proceeded into the Tagus, and told Captain Markland, the captain of the *Britain*, what I had done, and that the vessel was then in sight, about eight or nine miles from the port; that if he would go out, as my coal was nearly all expended, I had no doubt but she would be brought in. He said he could not, for all his officers were away. I then went on board a French corvette, and told the captain, who did not sail till the next morning; at daylight he did sail, and I have understood since, and indeed I know, that the vessel was brought in by him safe.

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1815. In point of fact, how long had you the vessel in tow?—Nearly three days; we towed her a distance of 300 miles.

1816. Without her mast?—Nothing but her fore-mast standing, and a little mizen-mast.

1817. During that was there a heavy sea?—Very heavy at times.

1818. What was the size of the vessel?—About 300 tons.

1819. You were steering about south, were you not?—Yes.

1820. Did not that bring a considerable strain upon your paddles?—Yes, very severe.

1821. Were you obliged to keep the whole power of the steam upon the vessel?—Yes, the whole power.

1822. How fast did you tow that vessel?—Never less than five or six knots an hour, and sometimes more.

1823. She had her fore-mast standing?—Yes.

1824. Had she any sail upon it?—She set her fore-sail.

1825. When you are in the River, going at your full speed, what swell do you make, with reference to a boat; do you endanger a boat?—No; so far from it, that when the *Confiance* was in the River, Captain Warren had a boat towed by the steam packet; we towed her for a considerable distance close up to the paddle-box, and there was no undulation of the boat; there was no tremulous motion on board.

1826. Did you haul her close to the paddle-box while she was going her full speed?—At her full speed.

1827. You are in the habit of going on board of other steam vessels when they are in the way?—I am.

1828. Do you observe any difference between the swell made by those vessels and by the *Confiance*?—Certainly; I am convinced that no boat could be hauled up to the paddle-box of a steam vessel that had the common wheel.

1829. You are no judge with reference to the change which has been made on the *Confiance*?—No further than that I was told by Captain Richardson, in the *Sister* vessel, that she never went more than seven knots an hour; and now we have gone nine; with sail we have gone ten.

1830. In smooth water?—The revolutions of the engine are 24 on an average, which is about nine knots an hour.

1831. When she is going against a heavy head sea, with a great deal of wind, what number of revolutions would she make; how much would that impede her way?—We have gone as few as 14 or 16 revolutions.

1832. When she is going 14 revolutions, how much is she going through the water?—I should think two knots, or two knots and a half; that we did off Cadiz.

1833. Is the diminution of the speed as much as the diminution of the strokes; would making half the number of strokes reduce the speed to half?—No, certainly not.

1834. Are the Committee to understand that you were getting the wind then, at the time you have spoken of when near the French vessel?—Yes, we were desirous to get her off.

1835. What way did she make to get the wind?—Not much less than three knots; two and a half and three; the wind was dead off shore.

1836. Was the wind right ahead when you were towing her off?—Right ahead, for we were desirous to give her offing; I was very much afraid of something happening in a large ship like that.

1837. You have stated that your vessel must have been going from 14 to 16 revolutions; was that right against the wind and sea?—Yes, the wind was at north-west; after we left Gibraltar one of our boilers began to leak; the wind was dead ahead; we were then about 40 miles from Cape St. Vincent; but in consequence of the larboard leaking, we could do nothing; I was therefore obliged to run back to Cadiz with one wheel, but during that time she never went less than 14 or 16 revolutions.

1838. Was it blowing so hard that a sailing vessel could not have shown sail?—She could not have carried any other sail than a topsail and the light sails.

1839. You were going right against the sea?—Yes.

1840. Have you ever been going with your head right against the sea?—Yes, we were then; when we were rounding Cape St. Vincent the wind was at north-west.

1841. Do you find your vessel rise to the sea?—Yes; the greatest power that she has is in a head sea; with these wheels she shows herself more in a head sea.

1842. Do

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1842. Do you mean that those paddles have the effect of raising her in the sea?
—Yes.

1843. Have you ever commanded any other steam-boat?—Not any other.

1844. Have you ever been to sea in any other?—No.

1845. Do you know the difference between the present paddle and the old?—
No further than that we went against the Lightning, and we beat the Lightning at a head sea; but when she had wind she bore up with us.

1846. What power has the Lightning?—The same power.

1847. Is she the same kind of built vessel?—A finer vessel.

1848. Do you, as an old sailor, think that you have ever seen weather in which you would not press your vessel against the sea?—Yes, decidedly; in a very heavy sea I should lie to, because I should not expend my fuel.

1849. Did you ever lie to?—No, I never lay to; we have had it blowing very hard, but with these wheels we have always got ahead.

1850. You never were out in any gale of wind when you did not make way?—
No, never; we always have made way, and it is my opinion that she would almost always keep off shore.

1851. Then you conceive of no weather in which you could not make way with your engines?—I should not attempt it in a hurricane, because I should do better with lying to and saving coals.

1852. You do not contemplate that there is any sea in which your engine would suffer?—Certainly not; I should try it all events, if there was a lee-shore, or anything of that kind.

1853. What is the lowest speed of going through the water at which you could keep the vessel under full control?—I should say from two to three knots.

1854. Could you at two knots keep your vessel under control?—Yes, excepting in a tide way; I could not do it.

1855. Supposing that the tide was flowing at the rate of four miles an hour, what is the lowest rate of going through the water at which you could keep your vessel under control?—I should say from five to six knots, with the tide; the tide flows four, and you are going one or two through the water; you must keep the way on her.

1856. What is the lowest way at which you could keep her under control?—
I should say six knots, with the tide, and five knots against it.

1857. Supposing that the tide is running four knots and you are going four knots, would not your vessel, though she does not come ahead in the River, be under perfect command, and go to the right or left as she was steered?—Yes, she would; but you would like to keep a little way upon her.

1858. Supposing a vessel to be going four knots through the water and the tide is going four knots, would not your vessel steer as well as if she were going at any other pace?—Yes, she certainly would.

1859. Would a vessel, if she were to drop down with the tide, be under command?—Yes, certainly; for instance, all the colliers, in going down the River, will not have a breath of wind, and they very often drop down with the tide, as often as possible, and they can be steered.

1860. Have you witnessed the effect produced by the steam vessels that go through the Pool?—No, I have very seldom or never observed it; I have seen it.

1861. Is it your opinion that the use of paddles like those in the *Confiance* would do much to mitigate the evil arising from the swell?—Yes; for instance, almost every day, when the steam-boats go by, it is like a gale of wind; the swell comes in shore and knocks all the boats; it does not do so with us.

1862. How near to London Bridge have you come in your vessel?—We have never been nearer than Woolwich.

1863. You have witnessed the swell produced by other steam-boats; do you observe that that is greatly increased by the speed at which they go?—Yes, of course; the quicker they go through the water the greater back-water they must have.

1864. You have seen two boats go together; does that have any greater effect upon the water than one?—Yes, one coming after the other.

1865. If they are coming abreast does that produce the same effect?—No doubt of it.

1866. Have you seen Captain Hall's letter in the *United Service Journal*, as to the mode of steering vessels in the rivers in America?—Yes.

1867. Have you considered that plan?—I do not myself consider that it would

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answer at all ; I do not think it possible, from what I have read, that a man could stand there and work the machinery.

1868. If it were possible, should you consider it an improvement?—For rivers, certainly it would be, particularly coming up the Pool.

Robert Grundy, called in ; and Examined.

Robert Grundy.

1869. YOU are pilot in the *Confiance*?—I am.

1870. How long have you been pilot of the *Confiance*?—Three years.

1871. Are you a branch pilot?—No.

1872. How then came you to be pilot of this vessel?—When she came along shore there was no branch pilot there, and so I offered my services.

1873. Were you in the vessel before the paddles were altered?—Yes.

1874. And you have been in her since?—Yes, generally.

1875. Will you describe the manner in which those paddles have affected her going?—In the month of October 1828 I was employed as a pilot on board the *Confiance* ; I was then going to Portsmouth for a detachment of the 42d regiment ; the *Lightning* also accompanied us ; we started at 11 in the day and the *Lightning* at 11 in the evening. On our arrival at Portsmouth, the *Lightning* was only three hours behind us after so long. We had then the old paddles, and at Beachy Head there had blown a heavy gale of wind ; it was my watch below, and when I came on deck in the morning, I found we had made little progress. We arrived off Brighton in six hours from Beachy Head, a distance of 16 miles. I have since had a trial with the *Lightning* in the Downs. The *Lightning*, on this side of the South Foreland, came away with us ; in about half an hour after coming by the Foreland we passed the *Lightning* at rather a quick rate, at about a quarter of a knot per hour ; we kept continually going away from her, at a little distance, till our commander thought proper to return.

1876. In short, you beat the *Lightning* and she beat you?—Yes.

1877. How much do you think this improvement has increased the vessel's power of going?—I think about two knots in very smooth water, and three going against the wind blowing hard.

1878. Has it improved the vessel, with regard to its tremulous motion?—Very much indeed ; formerly, when the sea struck the old paddle, it was a very great shock, and the engine flew away with the wheels ; now it is a regular motion. If the engine is making 20 revolutions, it continues ; if she is making 10, it continues ; the revolution does not alter.

1879. With regard to the sea, what difference has it made?—A very decided difference. I was in the boat when we towed it close to the paddles, which I think would have been impossible with the old paddles.

1880. When you pass a rowing boat, what effect does it have?—There is a little motion from the bow of the vessel, but nothing from the wheel.

1881. To what extent is that lift of water ; enough to endanger a small boat?—Not enough to endanger a small boat.

1882. Are you a good judge of that?—I have been three years continually employed in steamers.

1883. In what direction does the wave proceed that goes off the vessel?—By this new paddle the wave does not spread as it did with the old one ; formerly it spread, and kept getting wider and wider, now it keeps parallel with the vessel's side ; it spreads a little.

1884. Does it produce much swell abaft?—Very slightly ; if the water be disturbed, of course it curls a little.

1885. Is it less in quantity?—A great deal less.

1886. You have been accustomed to boats, and you have been accustomed to see the effect of this steam-boat both before and since she was altered, and you have seen others also ; do you think a steam-boat, so fitted as the *Confiance* is, could go through the crowded Pool without risk, arising from the sea made by her, to the small wherries in the Pool?—I consider that at the rate of seven knots, she would not disturb any wherry.

1887. That is not at her full speed?—No ; when the Pool is narrow she does not require to go at her full speed.

1888. If you were to go through the River at nine knots, her full speed, do you think that the vessels that are lying near you would be in any danger from the

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the swell that you might make, independently of the danger of running over them? —I think not.

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1889. Have you any information upon the subject, that you can give the Committee?—I was once caught in a very heavy gale of wind, south-south-west, with the new paddles; we endeavoured to get to Plymouth, and we were obliged not to bear up, because the wind was off the land, but we were obliged to come to anchor; we had a tremendous sea; there was no necessity for coming to anchor, excepting that the commander thought it for the safety of the vessel.

1890. Could you have been out in that sea?—Yes. I was out between Scilly and Cape Clear in quite as rough a sea; but then we had sea room.

1891. Does the vessel run over the water, or through it?—It generally lifts over the water; a steam vessel will rise.

1892. Were you lifted up by the bow of the vessel or the wheels?—I should think by the wheels of the vessel.

1893. Does it frequently happen that you are in sole charge of the vessel?—Always when I am acting as pilot; at least, under the orders of the commander.

1894. If you see anything ahead of your vessel, and you find it necessary to stop very suddenly, and you wish the engineer to stop the action of the paddles, how do you communicate with the engineer?—I call out "Stop there!" and a boy stands at the bow of the hatchway to repeat my words.

1895. Is there any chance of the boy misunderstanding your orders; does it often happen?—It never has happened; the boy stands at the hatchway.

1896. Does it strike you as a very great advantage to have a tube to convey the sound, that you may give the order yourself?—It would certainly save the boy.

1897. Would not that be inconvenient if you did not happen to be standing at the mouth of that trumpet?—Yes.

1898. And is not an engineer obliged to be sometimes in one part of the vessel, and sometimes in another; sometimes on the wheel, and sometimes abaft?—Certainly.

1899. Is not the rudder generally managed by a wheel?—Generally, not always.

1900. Did you ever see a steam vessel steering from the bows?—Never.

1901. In your opinion, if a vessel could be steered as easily by a man looking over the bows as at the helm in a river, would not that be a better way?—I think it would. I must say, that there is a great deal of facility in the present method; it is all done by the waive of the hand.

1902. Have you any doubt that if the man that was steering the vessel could see every thing passing under the bows, it would prevent danger?—If the pilot could be placed there.

1903. Speaking only of river navigation, if the pilot and the man were both to stand before the foremast, they would both see danger much more easily than on the paddle-box?—Yes; the man would be more handy.

1904. When you are at sea in a gale of wind, would you wish to be able to put a greater power of steam on; do you think the vessel would bear it?—No, I think not; sometimes I have been obliged to ease the engines, going ahead to sea, because she has so much sea upon her.

1905. You consider that it is safer to lie to under those circumstances?—Yes.

1906. Do you consider that it was necessary to lie to between Scilly and Cape Clare?—Yes, it was necessary for the safety of the vessel.

1907. Do you think it would have been unsafe to have gone on?—I think it was better to lie to, because we were running then for a rock, and we were afraid of over-running our distance; the wind was dead on the Irish coast, and we hove to; we could have gone against the wind easily.

1908. Have you ever been against the wind so as to be obliged to lie to?—Never.

1909. Do you think there is less risk in being at sea with a steam vessel than in a sailing vessel?—I think there is; one depends upon its sails, and the other upon its machinery.

1910. But, upon the whole, you consider the steam vessel to be the safer of the two?—I do.

Mr. John Johnson, called in ; and Examined.

Mr. John Johnson.

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1911. ARE you the engineer of the *Confiance*?—Yes.

1912. How long have you been so?—Three years the 17th of next month.

1913. Were you engineer of her before she had the new paddles?—Yes.

1914. Will you be good enough to state to the Committee what your opinion is with regard to this alteration, whether it has improved the vessel or not, and whether they are liable to injury or not, as compared with the others?—I consider they have a decided advantage over the common wheel. In the first place, they propel the vessel at a rate of from one to two knots an hour in smooth water faster than a common wheel, and from two and a half to three knots in a heavy head sea, or in any sea, I may say. I have had no trouble with them during the time they have been in, and they have been in the vessel 12 months.

1915. And during that time you have been exposed to very rough weather?—We have.

1916. Were you in her during the voyage which has been described by the captain?—I was ; I put the engines in the vessel.

1917. During the three years you have been in the vessel you have been about two years with the old wheels and one with the new?—Yes.

1918. Were you subject to any particular casualties in the old paddle wheels which you conceive would not have happened had the new ones been in their place?—Not any.

1919. Is the improvement confined to the paddles?—Yes, all the wheel is different, but the gear work is the same.

1920. Is it beavil gear?—No, not beavil gear. In the common wheel there is a safe runs right through the paddle-box leading from the engine, all one shaft ; and these have three bosses upon them, some two, and the arms are all fixed ; there are as many as 14 arms upon a 15-feet wheel ; with the same draft of water which we draw now the paddle would enter the water at an angle of $24\frac{1}{2}$ or 25, and leave at the same angle, in the old wheel ; but the new wheels meet the water at an angle of $57\frac{1}{2}$, and leave at $52\frac{1}{2}$. The improvement of the new wheel is this, even taking the water at $57\frac{1}{2}$, it does not strike the surface of the water in the same way with the common wheel, which was a back lash or check upon the engine, although not perceivable to the eye. It also does away with the back water. There is no body of water lifted, and the durability, I think, is equal to the common wheel.

1921. Are they more costly?—As to the price I cannot say.

1922. Should you judge from their general appearance that they were more expensive?—I should think they were more expensive. I should think from the workmanship that they would be more expensive.

1923. Will you state any other advantages of this wheel that you know of. Have you witnessed the effect upon the sea that is made by those paddles in boats approaching you?—I have ; the first boat we tried was Mr. Oliver Lang's, at Woolwich-yard, builder ; we had the boat hauled up within about six feet of the paddles, with a man in to steer her ; we started the engines ; they were running at the rate of 23 or 24 strokes in a minute, and the man was steering the boat.

1924. What was the boat made fast to?—She was fastened to the paddle-box.

1925. Did not that lift her head up?—No, she was six feet from the paddle-box ; the nose of the boat was six feet off.

1926. With your old paddles could you have put a boat in the same position?—No, certainly not. I cannot say whether the tide was with us or against us at the time.

1927. In the engine room do you find that the wheel makes more revolutions than it did?—The same. I perceive a great improvement in the sea with respect to an inconvenience to which we were formerly subject. By the old paddles the vessel was partly lifted out of the water ; the wheels lost hold of the water, being so shallow, and the engines were flying round ; I can scarcely calculate the number of strokes. In these wheels, owing to the deep immersion they have now, they never lose hold of the water, which keeps the vessel in a regular motion. In a regular motion there is more durability to the engine, because in an irregular motion there is a shock upon the engine altogether, and it is liable to more injury.

1928. Will you describe what effect a head sea has upon the wheels?—I never perceive any shock.

1929. To what do you attribute that?—Owing to the angle at which the board takes

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takes the water and leaves it, that tremulous motion upon the vessel is all done away with.

1930. In the engine room does the machinery remain much quieter than it used to do?—Yes.

1931. Have you ever had to repair the machinery?—The wheels have been taken to pieces, to ascertain the extent of the wear, and they have worn the thirty-second part of an inch.

1932. What is that as compared with other wheels, is it much or little?—I should consider that they are equally durable as other wheels.

1933. Would you have had that wear in the old wheel?—The wearing in the old wheel would be this. Some of them have an outer shaft to the wheel: I am alluding to the joints of the radius rods, which there are none of them in the common wheel. This is a fixed crank; instead of having a shaft to go through, it is a fixed crank to go to the paddle-box; there is a stay on the end of the engine-shaft; there is a radius collar which shifts on upon that, and there are radius rods attached to it. There is a radius collar which revolves upon the fixed crank, which is divided equally into nine parts.

1934. You have had this in use about a year?—Yes.

1935. Supposing you had had the old wheels, and taken them to pieces, would the proportion of the wear in the old wheel have been as much as it is upon this?—I do not see but what it would.

1936. You have been an engineer upon the old wheel, and you say, that there was as much wear upon that as upon the present wheel?—The old wheel was taken off altogether, they have fixed arms, and are brought together by bolts; those bolts are liable to get adrift, which we know to be the case in the Mediterranean vessels, in the best vessels; sometimes those bolts break at the end of the paddle board.

1937. The question refers to the relative wear of the wheels; would the old wheel have worn as much as that which you are now describing?—Yes, equally the same.

1938. Was it ever taken out to be examined?—Yes, it has been.

1939. When it was taken out, how much had it?—About the eighth of an inch; but that was in the three years.

1940. You stated that there were some additions in the new wheel that did not exist in the old one, and therefore those parts not existing in the old were still liable to considerable injury in the present wheel?—About a 32d they have worn in the twelve months, and I can give a reason for its being worn so much; they have bolts, and the eyes of the radius rods are iron, and case-hardened; the bolts which go through them are also case-hardened; the eyes of the radius rods, when hardened, had shrunk a little; they were turned nicely to fit the hole at first before they were case-hardened; the bolts swelled a little, so that when they came to put them into the places, they fitted them rather too tight; they could not turn those again without softening them, so they ground them in; you cannot make it penetrate into the iron more than the eighth of an inch, so that they ground part of the case-hardening to make them fit; they softened them, and they have now case-hardened them afresh, and put them on again. There has been nothing new; there was a cylindrical brass on the stay, which they have cut into halves, and made it to adjust.

1941. In the old wheels the principal shaft would pass to the outside of them, and the radii would be fixed both outside and inside into that solid mass of iron or wood, so that the external point of the floats is supported perpendicularly on the shaft?—Yes.

1942. In the new paddles there is a radius comes off the shaft; a double crank; then there is a rod which connects the outside of the floats and the inside of the floats; and consequently the pressure of the shaft is thrown directly on the wheel in the one case, and indirectly on the wheel in the other?—Yes.

1943. Is there not more wear in the one case than in the other?—There is more wear; there is more complication of joints.

1944. If you were going a long voyage, for instance to India, would you recommend, from what you know of those paddles, that a vessel should be fitted out with those paddles?—With Mr. Morgan's I should say.

1945. Are the paddle wheels at right angles with the paddle?—They are.

1946. Yours is a low-pressure engine?—Yes.

1947. Do you consider that a low-pressure engine is safer than a high pressure?—I do.

Mercurii, 28^o die Septembris, 1831.

Captain *Smithett*, called in; and Examined.

Captain *Smithett*.

28 September,
1831.

1948. YOU command one of the Dublin and Liverpool Post-office steam-boats?—I do.

1949. How long have you commanded her?—I have commanded her since the 22d of April 1826, nearly six years.

1950. A regular post-office packet?—Ours is a government packet, the post-office packet.

1951. You sail constantly, in every description of weather?—Yes, I have never failed, in any one instance.

1952. What tonnage is your vessel?—Three hundred and twenty-eight tons.

1953. What horse power?—One hundred and forty, two engines of 70 horse power each.

1954. How is the framework of the engine put in; how is it fastened, to the bottom or side?—To the bottom; it is secured to the top as well, to the ship's deck.

1955. What number of hands have you on board, exclusive of yourself?—Exclusive of myself we have 22 altogether, including stewards, engineers and firemen.

1956. You can work one wheel separately from the other in case of necessity, can you not?—We could do that in case of emergency.

1957. Have you any means of supplying the engines, so as to pump out water in case of a leak?—Yes.

1958. That is generally the case in steam-boats, is it not?—It is in all our boats.

1959. Is it your opinion, that in case a greater power of steam could be given, you could make use of it beneficially in a gale of wind?—I think we could in foul weather; it is only for want of power that in some circumstances the ship will fall off, and then of course you are liable to ship a sea.

1960. Do not you think if you were to increase the power, you would strain the vessel more than she could bear?—It might strain in bad weather; but in smooth water the vessel feels very little the effect of the wheel.

1961. Is that from the paddle being partly out of the water?—It is in consequence of the wheel not making so many revolutions as it does in smooth water.

1962. Supposing you could increase the power, would not that make the wheel come down with great power, and so affect the vessel?—It would drive the wheel faster and affect the ship more.

1963. Would it not come down with such great violence as to endanger the carrying away of cattle on board, for instance?—Not at all.

1964. Is not the reason of her not making so many revolutions, in consequence of the paddle being partly out of the water?—Yes.

1965. Then the strain is upon the engine, and not upon the vessel?—It is.

1966. Do you in smooth water create any sea?—Very little, except when we are in rivers; you see the sea running upon the shore, but nothing more.

1967. Does that proceed from the bow of the vessel?—From the form of the ship; a full vessel will always make more swell than a sharp vessel, because she passes easier through the water, and leaves little or no ripple.

1968. You do not think that proceeds from the paddle-wheel?—No, very little.

1969. Do you mean to say that there is not more swell from a steam vessel than from a sailing vessel?—Yes.

1970. Part then comes from the paddle-wheel?—Yes.

1971. Have you seen the effect of small steam-boats in rivers?—Yes.

1972. Do you observe that they make a great ripple in the water?—They do.

1973. Your observation is confined to the rivers Liffey and the Mersey?—In our packets we do not go up the Liffey.

1974. But you go to Dublin?—Yes, we go to Dublin, but I generally go up by land.

1975. Do you observe that the swell that the steam vessel makes is as much as the other steam vessels make that ply on the river?—I do not think she does make so much.

1976. Since

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Captain Smithett.28 September,
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1976. Since you have commanded the *Dolphin*, how often has she been repaired?—She has a general overhaul every year.

1977. For what period have you commanded her?—Not six years I have had the command of the vessel.

1978. She is generally taken into dock once a season, is she not?—Yes; sometimes more frequently.

1979. Have you observed that the wear and tear has been greater than in a sailing vessel?—Decidedly more than a sailing vessel.

1980. Have your voyages been more frequent than a sailing vessel?—Yes; we have gone over three times as much ground as a sailing vessel in that time.

1981. Have you observed whether the wear has been in the vessel or the engine?—The engine; the vessel has suffered very little.

1982. Her shell has not been broken?—Not at all.

1983. What boats have you on board?—Three attached to the boat; we generally carry two.

1984. Since you have been on the Dublin and Liverpool station, have you had occasion to notice the trading vessels?—Yes; I have met them at sea very frequently.

1985. Have you observed that they appeared to be overladen either with passengers or cattle?—They carry a great deal; I have seen them with five or six hundred passengers.

1986. Do they carry more than you should feel comfortable with on board?—Yes.

1987. Do you not consider that so much top weight is bad?—Some of the cattle are below; for the two years past they have put them below; they have had the cabins taken out in some of the vessels, and put the cattle down; they have also a cargo of bale goods and different things.

1988. You think they are frequently laden more than prudence would permit?—I do not know whether it is prudent or not to load them so heavily.

1989. Would you load a vessel so if it were perfectly optional to you?—I do not know; if it were a private vessel I should try to get all I could; those vessels are very different from our's, they are not obliged to go to sea in bad weather.

1990. They are caught in bad weather sometimes, are they not?—Yes.

1991. Do you think the lading that a sailing vessel has which goes up a river renders it more dangerous than the cargo that is generally put in a steam vessel?—I think in a gale of wind it does, because the cargo of the vessel is liable to slip under the vessel, which would make it dangerous.

1992. You observe that in steam-boats the sea comes over them a great deal?—Yes.

1993. If she falls off and loses her way, and a sea breaks over her, are not the animals on deck apt to get smothered?—Yes.

1994. Were you present when the timber-work was examined?—I was.

1995. Could you state to the Committee whether the failure principally occurred in the wood-work?—I saw no failure in any part of her.

1996. Was her plank stripped to examine the beams parallel to the boilers?—Yes, it was.

1997. Stripped inside?—Partly; we took out some pieces to examine the timbers.

1998. And were the timbers perfectly sound?—Yes. I called a shipwright on board, and he said that he could not find the slightest fault with them, that she was firm all over.

1999. Where was she built?—At Harwich.

2000. You have stated that the greatest defect appeared in the boilers?—The boilers had the greatest defect.

2001. From the time they were put in till the period of examination, what was the length of time?—The boilers had received repairs at different times.

2002. How soon after the period you took the command did you examine the boilers and find a defect; how long had they worked?—Two years and a half before we took them out to repair them; but they had been repaired as much as they could in the ship.

2003. At that period they went through a thorough repair?—They were taken out, and went through a thorough repair.

2004. What is the greatest speed you have gone?—I think we have steamed nearly 11 knots, not quite, but very near.

Captain *Smithett*.

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2005. Have you noticed whether that overloading the vessels takes place at Liverpool or Dublin?—They overload most from Dublin; the cattle all comes from Dublin.

2006. Have you seen a steam packet go to Cork, and that way?—There is one that was built for Wexford, called the *Marchioness of Wellesley*, she is now running between Liverpool and Dublin.

2007. Was that a vessel that was lashed the other day?—Yes.

2008. Was she overloaded at that time?—They said she was; I did not see her.

2009. Have you ever seen her start from Dublin?—Yes; I thought she had too much on board for a winter season, in summer you may take a greater quantity than in winter.

2010. Are you aware whether there are any regulations to prevent vessels taking more than they ought to do?—I have heard that the authorities have interfered.

2011. How many people should you think might be taken in safety in a steam-boat, per ton?—I think my packet is capable of carrying 500, and she is 328 tons, not quite two to a ton.

2012. Do you think a vessel would be overloaded with two to a ton?—No, I do not think she would.

2013. But not more?—Not more.

2014. In what proportion would you reduce the people, to take cattle; taking horses for instance?—Much depends upon the qualification of the vessel; if she could carry horses on board, you might put them on the same space as on transports, 20 inches.

2015. If you had 400 passengers, how many could you take with safety?—If they were below, I think we could take 60 or 70 horses.

2016. Would you put 60 or 70 horses below, with that number of people on board?—I could not in my vessel.

2017. Do you know any vessel that could?—Yes.

2018. What size is that vessel?—Four hundred tons.

2019. You think she could carry those with safety?—Yes.

2020. In the winter time?—I would not send a vessel to sea with that number on board; if I were at caught at sea I should not be afraid of having that number on board.

2021. What number of cattle would you put, in addition to 400 passengers, for the 200 people, if she were your own vessel?—I think she might take 50 or 60 horses.

2022. Supposing you wanted to take no people, and wanted to take only horses, how many would you take?—In about one horse to five people, if you had room on deck below to take them.

2023. Is that register measurement, or builder's?—Builder's measurement.

2024. Do you think a vessel might take more horned cattle than it could horses?—No, I think not.

2025. Then your observation would apply to either?—Yes.

2026. Horned cattle are lashed, are not they?—They are put in an inclosure, and if it comes to be bad weather, they are lashed I believe; I have never been on any vessel where that has been done.

2027. In point of fact, is it within your knowledge that the steam-boats between England and Ireland have on several occasions carried more than two to a ton?—Yes, I think they have; I have seen them carrying 700 passengers with a 300-ton boat.

2028. Do you think they have overloaded themselves?—I do not think they ever have brought more than that.

2029. These vessels frequently take a great cargo of goods, as well as passengers; these observations which you have made apply to passengers only?—They take cargo at the bottom of the ship.

2030. That brings the vessel down?—Yes.

2031. And that loses the efficiency of the vessel?—Yes, it does, in some degree.

2032. Do you think a vessel of 300 tons would be capable of carrying any cargo, carrying 600 passengers?—I think she would have quite sufficient load in bad weather.

2033. Do

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2033. Do you think it would be possible to make any regulation as to a vessel being brought down a certain depth?—No, I do not think it would be possible.

Captain Smithett.

2034. Would not such regulations be prejudicial to the trader?—I think they would.

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2035. Is it your opinion that a fewer number of men than you have in your boat would be sufficient, in all cases, for the management of a vessel of your class?—No; I think we have quite as few as necessary. We have a sufficiency to work the vessel.

2036. Are the other vessels which are not post-office vessels, manned as strong as you?—Not quite; I do not think there is so much difference in the hands in the ship; they have cargo to hoist in and out, and we have none.

2037. How many firemen?—Four.

2038. How many engineers?—Two.

2039. Are the firemen, in case of accident to the engineers, capable of taking charge?—I think some of them; most of them are.

2040. You are capable of taking charge yourself?—Yes; I can work the engine myself as well as the engineer.

Sir John Hall, called in; and Examined.

2041. ARE you much accustomed to steam vessels?—Ever since they have navigated the river Thames; I have been acquainted with the river Thames during the last 30 years.

Sir John Hall.

2042. You hold a situation in the St. Catherine's Docks?—Yes, I am secretary in the St. Catherine's Dock Company.

2043. The steam vessels come to the docks at your wharf?—They do, the greater number of them.

2044. Are you much in the habit of going upon the river?—Yes, occasionally.

2045. Have you witnessed the inconvenience occasioned by steam-boats going up the Pool?—I have.

2046. What do you consider that to arise from?—Principally from the want of proper regulation of shipping in the river Thames, and from the ineffective mode in which the bye-laws are enforced. I have been upon the river, and taken the admeasurement of distance between two tiers of the shipping, which by the bye-laws is required to be kept clear to a width of not less than 300 feet. In consequence of the numerous complaints made by pilots and captains navigating ships to the St. Catherine's Docks, of the want of attention to the bye-laws, I have examined the state of the Pool, and I have found, on most occasions, that those complaints were well founded. Instead of finding a clear passage of 300 feet, I have frequently found only from 70 to 130 feet.

2047. The swell extends from shore to shore, which is made by steam-boats, does it not?—It has that effect; but the accidents to which I allude, and to which I have more particularly turned my attention, have been from the confined state of the navigation, from which boats have come in contact with the paddles of the steam vessels, and also in contact with the vessels' stems.

2048. Have you any knowledge with regard to the navigation of steam vessels beyond the river Thames?—No, I have not; occasionally I have seen them elsewhere; but as far as my practical observation goes, it is confined to the navigation of the river Thames.

2049. Have you ever been near a steam-boat?—Yes; I was a short time ago nearly swamped in consequence of the narrow state of the Pool. I was passing between two tiers of shipping in a boat, for the purpose of taking the admeasurement of the distance of another tier, when the channel was so extremely narrow that there was not room between the outer vessel and the steam-boat, the latter having been compelled to pass close to her, and if I had not caught hold of a rope hanging from the bowsprit of the outer vessel, and thus stopped the boat, we should have been under the starboard paddle, and most likely have lost our lives; a state of things arising from the harbour-masters not keeping the Pool clear. Allow me to call the attention of the Committee to two defects in the Act of Parliament, passed in the 10th year of the reign of George the 4th, c. 124, with a view to regulating and improving the navigation of the river Thames, and the Committee will find that the harbour-masters have not the power of enforcing the bye-laws effectively with regard to some ships, and in most instances not at all in respect of

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steam vessels. The Committee are aware that bye-laws have been made by the Corporation of London, in August 1829, regulating the mooring of colliers and other ships, and also of steam vessels. In the Act just referred to, the Committee will find by referring to the 13th section, which empowers the Corporation of London to make bye-laws, that the word "steam-boats" has been omitted; whereas this description of vessel is particularly described in all the previous sections, so that in point of fact so much of those bye-laws which have for their object to enforce penalties upon the owners or masters of steam-boats (with the exception of the particular regulations provided for specially by the 9th section of the Act), are inoperative, as the penalties cannot be recovered. The Act of Parliament being one of a penal character would be construed strictly; and therefore these bye-laws are in so far ineffective, the word *steam-boats* having been omitted. The other defect which I would wish to call the attention of the Committee to, is in section 9; they will there find that "in case the owner, master, pilot, servant, or other person having charge" or command of any ship, vessel, or steam-boat" shall be guilty of the offences named, and then goes on to state the amount of penalty; but when you come to the part of the section empowering the recovery of the penalty, the word "owner" only is mentioned; the words "master, pilot, servant, or other persons" having been left out; the penalties therefore cannot be enforced, if the owners are not within the reach of the Act of Parliament. The consequence is, that the Corporation of London were unable to proceed to recover a penalty some time ago in a gross case, because they found that under the Act they were not able to enforce it. The 9th section also provides, that a reasonable time shall be given, and inserted in the harbour-master's notice for the removal of any vessel which shall have been moored in such a manner as to create impediment; which reasonable time, with reference to the bye-law in page 30, has been construed to mean 12 hours. The effect of it is, that the harbour-master possesses no power to remove instantaneously that which constitutes frequently a serious impediment at the moment.

2050. Has he not the power of taking up a vessel in her berth?—No, not immediately; because the Committee will perceive that the regulations all relate to vessels moored, and not to ships merely making fast or lying at for a temporary purpose; he has no power to enforce penalties except upon notice; and without a penalty, applicable immediately on commission of the offence, it is impossible to enforce any regulation on the river.

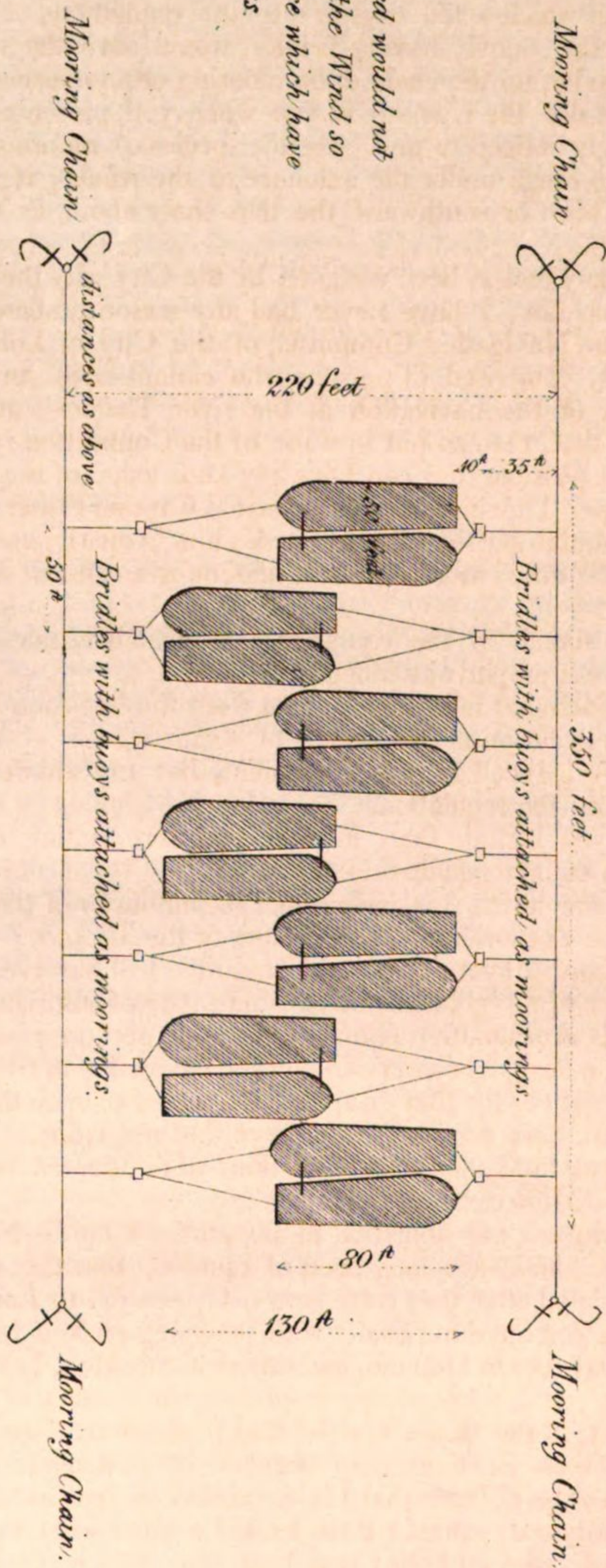
2051. When he says that they must moor here or there, do not they attend to him?—I am sorry to say they seldom do; and the harbour-masters require some additional power by Act of Parliament to enforce those regulations. With a view to correct the defects of the Act 10 Geo. 4, c. 124, referred to, and of further removing and preventing obstructions to the navigation of the river, which now contribute in so great a degree to the accidents which have occurred, and the inconvenience which is experienced from steam navigation, I recommend that such Act be amended; that the penalties imposed by the 9th section be recoverable from the master, pilot, servant or other person having charge of the ship, vessel or steam-boat, as well as from the owner. That penalties be imposed upon any person who shall obstruct the harbour-masters in the execution of their duty. That penalties be imposed upon the owners, masters, pilots, servants or other persons, having charge of any ship, vessel or steam-boat, which shall in any manner obstruct or impede the passage, of the width of not less than 300 feet, directed to be kept free and unobstructed, by bye-laws, framed under the authority of the Act, or of any other Act or Acts for rendering more commodious and for better regulating the Port of London, or who shall make such ship, vessel or steam-boat fast, or moor her at any tier in which the ships, vessels or steam-boats shall amount to or exceed the number limited by any of the said bye-laws; and also of all lighters or craft which shall be laid at the outer side of the outermost ship or vessel lying in any of the said tiers, so that the 300 feet before referred to shall be a clear, free and unobstructed passage, according to the real intent and meaning of the said bye-laws. That the harbour-masters shall have the power to order to be removed, and if necessary, to cause to be removed, any such ship, vessel, steam-boat, craft or lighter forthwith, without any notice whatever. That proper moorings be laid down, with bridles, at such places, and in such manner, between the King's Arms, Limehouse, and London Bridge, as shall be deemed most convenient for the accommodation of shipping in the Port of London; the number of ships, vessels and steam-boats to be allowed to moor thereat to be limited and defined, regard being had to preserving a free passage

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IMPROVED PLAN for *MOORING SHIPS* in *TIERS*:

allowing to each Ship a clear side for Craft.

Tiers thus moored would not be influenced by the Wind so much as those are which have no fixed moorings.



Mid-Channel of the River.

West ← *East*

Explanation.

The above represents 44 Vessels moored in one Tier, each Vessel of 250 Tons register. The space which has been allowed is 130 feet in length, and 50 feet in width, for the station of two Vessels, securing a clear side to each Vessel for loading or discharging, without shifting berths. The depth of water has been computed at 35 feet, the extreme depth at the top of a spring tide, which upon an angle of 45 degrees will require a bridle-chain of 12 fathom, and 10 feet in addition allowed for fastenings to the buoys. If the above method of mooring were adopted it would not be possible for Masters to moor Vessels beyond the number allowed in each tier, as the buoys would point out the vacant moorings; a considerable saving in space would take place, obstruction to Navigation in mud Channel be avoided, and the trouble and expense of raising the chains to moor and unmoor be rendered unnecessary.

John Hall.

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passage or channel of not less than 300 feet for the purposes of navigation, in the set of the tide ; and that penalties be imposed upon the owner, master, pilot, servant or other person having charge of any ship, vessel or steam-boat, who shall moor at any other place than at the mooring-chains so laid down, without a permission in writing from the senior harbour-master. If the Committee will permit me, I will put in a copy of a plan for mooring, which I submitted to the Corporation of the city of London four years ago, by means of bridles and buoys, by which the number of ships in a tier would be so regulated that it would determine the penalty as to any vessel which acted contrary to the regulations. There is also another advantage, as the buoys, having bridles, would save the vessel the trouble and expense of heaving up the chain upon mooring or unmooring.

2052. What did the City say to you when you presented it?—They said they were exceedingly obliged to me. By this species of mooring ships the tiers would not be liable to range under the influence of the winds ; if the wind blows strong from the northward or southward, the tiers sheer about, as the colliers now all lie at their anchors.

2053. Has any reason been assigned by the City why they have not adopted it?—No, there has not ; I have never had any reason assigned, but, from my own observation, the Navigation Committee of the City of London are, with three or four exceptions, composed of persons who cannot have any practical knowledge of shipping or of the navigation of the river Thames ; and I need do nothing more to show that, than to put in a list of the Committee ; as, with the exception stated, it is not possible they can have any knowledge of the river or of the method of mooring ships. The senior harbour-master, Captain Fisher, is very assiduous in his duty, but he cannot get the others to assist him properly, and without this the regulations cannot be duly enforced ; due discipline is not maintained by the Navigation Committee.

2054. You stated, in the course of your evidence, that the regulations of the bye-laws were not properly attended to?—Yes.

2055. You included this notice given from the Mansion House, June the 24th, 1830, for the regulation of the speed of steam vessels—[*the same being shown to the Witness*] ?—I recollect this document, but my answer is that there is no power to enforce the regulation.

2056. Did you include that, in what you were stating, as to the bye-laws not empowering to enforce penalties?—I did.

2057. This regulation was made under the authority of the bye-laws, by the Lord Mayor and the Corporation, conservators of the Thames?—No, it is a proclamation from the Lord Mayor only ; the Committee will observe, although this partakes of the character of a regulation, there is no mode of enforcing it.

2058. Is this proclamation issued under that authority which the Lord Mayor and Corporation have, as conservators of the navigation of the Thames, to endeavour to enforce regulations for that purpose?—I am of opinion that the Lord Mayor, or the Corporation, have no power to enforce that regulation.

2059. Do you think, if those regulations were adopted in the river, they would be beneficial?—Most certainly.

2060. Do you see any objection to any part of them?—None ; on the contrary, I am of opinion, and have long been of opinion, that the speed of steam vessels should be restricted after they have passed Greenwich to London.

2061. Have you anything to do with sea-going packets?—Yes, we have some ; we have one that goes to Holland, and others to Stockton, Leith and the North coast.

2062. Have you any knowledge respecting the number of passengers they carry?—With respect to the steam vessels that proceed on long voyages, or over sea, I have never seen in them any number of passengers beyond what I considered safe. The steam-boats that I have principally seen are upon the river Thames ; I have repeatedly seen some of them loaded beyond what I considered in a state of security ; I have seen on board one boat, the Albion, that went on a particular occasion from our own wharf, about 1,000 passengers ; and I have witnessed a greater number on board other river boats than I thought safe. I do not think the Albion is more than 250 tons, and she had, notwithstanding, upwards of 1,000 passengers on board ; I have also seen, on repeated occasions, vessels of her size with about 700 passengers on board.

2063. Where was she coming from?—St. Catherine's, and going to Gravesend on an excursion ; certainly it was more than was secure, because it is well known

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(See Plan.)

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that there is a top weight; the passengers are generally upon deck, and upon the slightest object of curiosity they all run to one side or on the other, and the vessel thus becomes unmanageable and unsafe.

2064. Do you include the engine-room in that measurement of 250 tons?—There are two measurements, the builder's regular measurement and the Custom-house measurement; the Custom-house deduct from the builder's measurement the space occupied by the engines; speaking of the builder's measurement, that would not be more than about 250 tons. She is a boat flat floored, and infinitely safer and better calculated to carry passengers than one of a sharp build, which are more liable to be crank. Within my own observation I have never seen in any vessel bound foreign, too many passengers, and I have seen a great many; I should not think upon an average that I ever saw on board of any vessel going to sea or going coastwise, more than one passenger or numerically a passenger and a quarter per ton. In the Margate boats they have occasionally exceeded that greatly; I should think they have taken at the rate of three per ton, and on particular occasions more than that. The Albion had upwards of four per ton. The Margate boats are considered within the river, although sometimes they are exposed to very coarse weather down below; so much so, that they cannot even enter the harbour of Margate, and are obliged to go round to Ramsgate to land their passengers.

2065. Have you anything more to add to your evidence?—If the Committee would permit me just to state that I think considerable improvement might be made with respect to matter of regulation, not by legislative interference, but by the proprietors of steam-boats. It occurs to me that accidents might be prevented from steam-boats coming in contact together, if there was an understanding that when approaching unexpectedly, both were to put their helm a-starboard or a-port, whereas the one puts his helm a-starboard and the other a-port, by which they actually come into collision. There is another regulation as respects steam-boats going down and up the river Thames: I would recommend that every boat going with the tide, ought to keep in the strength of the tide, as boats going against the tide always hug the shore to keep in the eddy. These slight regulations would be advantageous.

2066. That is the case, is it not, at present?—Not that I am aware of. There is another thing should be put a stop to, racing, which is attended with considerable danger.

2067. If both boats put on their fullest speed, and happen to be near together, you call it racing; but does not a boat when she starts put on her whole speed, and go as fast as she can; another boat also would do the same; and would not the only way of preventing that be, to prevent boats sailing at the same period from the same place?—I should think the latter regulation would be almost incompatible with steam navigation. It may be a question of fact with those on board as to what is racing, but I apprehend it seldom occurs that two run a great distance abreast together, because usually one must be astern whilst the other is ahead.

2068. Why is that?—Because they do not start from the same place together.

2069. Supposing one vessel to start from the St. Catherine's Dock, and just at the moment she is at Blackwall, the other started from Blackwall?—I conceive that the vessel starting from the St. Catherine's Dock, coming at her full speed, and the other not having her full speed, would be first; those circumstances may arise undoubtedly.

2070. Do not all vessels immediately after they get clear of all craft put on their full speed?—Generally; but in taking in passengers they are frequently delayed going down.

2071. Supposing a vessel is detained and another vessel gets abreast of her by that means, would it not appear hard to say which of those two is the one to stop?—Generally speaking it would; but I do not apprehend that would constitute racing.

2072. What does constitute racing, because they all go as fast as they can?—They may either apply additional power of steam or the other vessel may not have put on her full power.

2073. Do not they put on their whole power?—No; that is not always the case. I apprehend that the commanders of the boats or the proprietors of them would rather reserve some of the power, because applying her full power must be more likely to affect her machinery.

2074. When they come alongside of each other are they not in the habit of putting on an extra pound on the spindle?—I do not know.

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Thomas Law Hodges, Esq., a Member of the Committee, made the following Statement :

I WAS going in a steam vessel from Aberdeen to Leith, about five years ago, and we met with very bad weather. The vessel, as well as the machinery, were both in the opinion of competent persons on board wholly unfit for that navigation. They said that the vessel was an old vessel, and that neither in her machinery nor construction was she fit to navigate the sea. The captain himself owned to me that the vessel was not fit for that sea. I do not know the name of the vessel.

2075. Was the vessel usually employed in that passage?—No; only put on in consequence of a demand for another vessel.

*T. L. Hodges, Esq.,
M. P.*

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Walter Frederick Campbell, Esq. a Member of the Committee, made the following Statement :

THE only information that I can give the Committee, with regard to the *Rothsay Castle*, is this; that, of my own personal knowledge, I knew that vessel, in *Loch Fine*, running from Glasgow to Inverary; that in passing some of the points, *Toward Point* and point *Arch Lamont*, where a sea occasionally runs, I did not think her qualified to work well, even in that confined sea; I also know that she was a very old vessel, and that she plied at that time on the station. She was one of the vessels belonging to a most respectable Company, who every year or two built a new vessel, and invariably improved upon them; the ships were looked at very narrowly by that Company, and were built, to the best of their opinion, in good order; but last year this Company was broken up, the vessels were all sold in different quarters, and the *Rothsay* was sold for the station where she was lost. Mr. Berry, connected with one of the principal houses in Glasgow, purchased this vessel I am speaking of, which was called the *Toward Castle*, a larger one than the *Rothsay Castle*, intending to ply her from the Clyde, round the Mull of Kintyre, to the Western Islands of Scotland. Before he purchased this vessel he had her surveyed, and she was reported to be a good vessel, and a good pennyworth; but to qualify her for the station to which she was going, he determined to cut her in two and lengthen her, that he might put up beds for this long voyage: when they came to cut her in two they found that the whole of the upper works, the timbers in a line with the boiler, were in such a state that, to use his own expression, he could have kicked them all to pieces with his feet, though she appeared to be quite sound: consequently, if I may be allowed to adduce a reason for this statement, I can say that I should think that the *Rothsay Castle* must have been in the same state, and, consequently, that when she got a-ground, the vessel came in two, as we know was the case with the *Rothsay*. I think that when the planking of a vessel depends upon its side, she must, when she strikes the ground, break in half; upon this ground I consider that steam vessels ought to be properly inspected.

*W. F. Campbell,
Esq., M. P.*

Jovis, 29^o die Septembris, 1831.

Sir Robert Seppings, called in; and Examined.

2076. YOU are aware that the object of this Committee which is assembled is to consider whether any legislative enactments are necessary to render Steam Navigation more secure than it has hitherto been. If you have any observations to make on the construction of steam-boats, which you think would be valuable, the Committee would be obliged; and more particularly relative to those that carry passengers?—I know of no improvement that can be made as to safety upon the steam vessels that are now in use by His Majesty, and what we are now making. They are filled in solid all the way up, and their internal fastenings do not lie to a right angle; they lie to an angle of 45 degrees, and a system of trussing is introduced, and partial strength is avoided, and one uniform strength is introduced, if I may be allowed the expression, from stem to stern; no partial spot is unprotected.

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2077. Do you mean, by what you have stated, to advance that you consider it necessary that a steam-boat, which is only intended to carry passengers, and in some instances to carry passengers only within a river, would require to be built of the same scantling as the men-of-war steam-boats?—Not if I could be certain that they would never depart from the river; I should say that they might be made slighter.

2078. With regard to those that go to sea, do you think that they ought not to be slighter than the men-of-war?—Certainly not, nothing should be left undone that is now done.

2079. When a vessel is fitted in the way you speak of, has she any internal lining over her timbers?—She has an internal lining over her timbers, but it is a mixture of iron and wood.

2080. Are the timbers covered?—Yes, they are covered.

2081. So that you cannot get at them without removing something in the way?—Exactly; but that is easily removed.

2082. A vessel being so fitted, and the timbers out of sight, how often would you consider it necessary in a merchant steam-boat, built as these boats generally are, that those timbers should be surveyed or looked at, to ensure the vessel being seaworthy from rot or from the strain of those timbers?—Much of that would depend upon the materials they are built of.

2083. The materials you use, on an average, in merchants' yards, that would render them safe from rot: how often do you think it would be necessary to have them looked at?—I should say that the greatest period should be three years, the very extent of it; but then I should say one, if a vessel was built under cover.

2084. You think they would be secure certainly for three years?—Yes.

2085. Would you think the same precaution necessary for the security of the public with regard to vessels that run only up and down the river, or between two parts of the river?—I should think not.

2086. Perhaps five years would do for those?—I do not know; I have seen a vessel with every prospect of success give way in less than five years.

2087. Do you think it would be safe to leave it for five years?—I think if she had no symptoms of that, it might; but the Committee will allow me to say, I have seen ships launched side by side, and with the very same materials, and one has been unfit in three years for service, and the other has run for many years.

2088. Do you think, generally speaking, it would be safe that vessels passing up and down the river were looked at once in every five years?—No, I should not say five years.

2089. Would you say four years?—I should say three years, to the best of my opinion.

2090. Do you conceive that an average size would be given correctly, according to tonnage, for vessels of that description of which you are speaking, passage vessels navigating by steam, or would it be more wise to leave it to the discretion of the surveyors to see that she is perfectly seaworthy; because, by having a greater number of timbers they would be smaller; and by having a smaller number, they would be larger?—Yes; I think I would leave it to the surveyors, that they should declare her seaworthy on looking at her. I should have a check for a vessel of such a length; I should then propose a certain degree of scantling for the size of the vessel.

2091. Would not timbers, being put closer together, and of a smaller size, be equal to those of a greater distance and of larger size?—I hope the Committee will insist that all ships shall be filled in, or otherwise to put a general description of timbers from end to end would make the fabric become very expensive.

2092. Although the fabric of building is very loose, if other vessels are built differently, you would hardly put them out of employment; would it not be going far to say that they shall all be built in a certain manner; would not the better way of obtaining the object, if such a thing were determined as to have a periodical survey of each vessel, be to leave it to the surveyor or practical man to see whether the scantlings are altogether fit for the service for which she is to be employed; would it not be equally secure to the public?—I should think nothing would induce me to give up the filling-up of the ships, because we have had important instances where ships would have gone down if they had not been filled in; a cutter, of the Isle of Man, lost all her stern-post, and a considerable way up, what is termed the dead wood, and the bottom. We had one of our steam vessels, the African, going round

round to Portsmouth, got upon the Kentish Knock, carried away her keel from end to end, and a great deal of the plank at the bottom; but, nevertheless, she got round to Portsmouth without making little or any water whatever, which was prevented by the plan I have recommended.

2093. Was the plank torn aft?—Part of it, the starboard; there are several instances of the same kind; the Gloucester had a very considerable shock in coming from the Mediterranean, in striking upon the famous rock off Gibraltar; she was very much shaken, but she made no water.

2094. Were any of her timbers broken?—No, I did not see.

2095. She must have gone down if it had not been for that?—Yes, she made little or no water, her keel was gone.

2096. Supposing that there were an enactment to require a survey of steam passage-vessels, such as now alluded to, how long would it occupy a ship-builder, a person who was employed, so to examine a vessel, to satisfy himself that the timbers are in a proper state, and that the frame-work is in a proper state?—I should think that in a day he might do that.

2097. Can you give the Committee any idea what would be the average expense of doing such a thing, according to builders' charges?—I do not think I can answer that point exactly.

2098. Would it come to 20 l. for a vessel of 400 tons?—Nothing like it.

2099. How far would that survey be with regard to the boilers?—Monthly in some instances; I do not say generally so.

2100. Of course you are conversant with all kinds of vessels, with sailing as well as steam vessels. Is not frequently the defective state with regard to what is called the bulk heads; are they built sufficiently strong, or do you see any necessity for their being built, generally speaking, stronger than they are?—No stronger than the government are, because they are no part of the fabric of the ship.

2101. Would you recommend that the frame-work of an engine should clench upon the bottom and not upon the sides?—To clench to the bottom.

—Mr. Joseph Miller, called in; and Examined.

2102. YOU are an Engineer, and have a great deal to do with steam-boats?—*Mr. Joseph Miller.*
A good deal.

2103. Are you of opinion that it would be practicable to ascertain, by the revolutions that the engine makes in a vessel, the rate she is going, by first ascertaining what she will do with her greatest power, say 26 or 28 revolutions, or whatever she has, if she goes nine or ten knots to those 28 strokes, could you calculate what number of knots she is going, when, instead of making 28, she makes 18?—Yes, I think it might be done, but I think it would be done more accurately by making an experiment for each rate; that would be the best way to ascertain what the speed would be at each rate. I would recommend that you should ascertain by the log, or any other method, what speed she was making at any given number of revolutions; that would be, in my opinion, the most accurate mode of doing it.

2104. If you ascertain that in smooth water, when she is making 18 revolutions, she is going six miles in an hour; in a strong sea against her with a fresh wind, would she go at the same rate as in smooth water, if she made the same number of revolutions?—I think not, though she made the same number of revolutions.

2105. Then there would not be a correct mode of ascertaining the rate at which she is going?—No, not under all circumstances.

2106. Is there any mode, taking all circumstances, by which you could always ascertain the speed?—It would be a very difficult problem, because it would be affected by a great variety of circumstances, arising from weather and difference of current, and other circumstances.

2107. Supposing that in smooth water your greatest power makes your engine revolve 28 times, when you get her against a head sea, and with a strong wind, you cannot get the engine to make that number of strokes?—Certainly not.

2108. Would that be carried to the extent that the engine would be stopped the quantity in an equal proportion, so as to enable you under all circumstances to ascertain the speed at which she was going?—I think it is difficult under all circumstances. In smooth water you might come to a very good calculation; between Gravesend and London you might ascertain with tolerable accuracy.

2109. You might ascertain the rate of a vessel in the Pool, for instance?—Yes, with tolerable accuracy.

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2110. If you could ascertain that, would it not be perfectly easy to convey that on the deck?—Yes, it would be very easily done; but still, in my opinion, it would require an experiment in each vessel at the rate you want the vessel to go at. If you fix upon seven, eight or nine miles an hour, in my opinion you ought to make an experiment on each. The draft of the water would affect the speed of the vessel, because it would affect the resistance of the vessel; if she had a greater load in her it would also increase the dip of the paddle, and therefore the engine would go slower.

2111. Then she would go slower revolutions?—Yes.

2112. Would it be an operation of much inconvenience or difficulty to make each vessel put her power to proof at her greatest speed, and at the speed of six knots, and at the speed of three, to ascertain the number of revolutions?—No, I apprehend it would be a very simple experiment.

2113. Supposing that an index was put on the deck to describe when she was going at those three rates, her being loaded, or her not being loaded, would that vary the speed of the vessel half a mile an hour?—No, I should suppose not in common passage vessels; it would make material difference in vessels carrying cargo, of course.

2114. What difference do you suppose it would make in vessels carrying cargo?—A very considerable difference.

2115. How much?—I cannot say correctly.

2116. Have you ever tried experiments of this kind?—No, but they have passed through my mind; it is very familiar to me.

2117. How often do you consider that the boiler and machinery of a steam-boat require examination; a couple of years or three years?—I am not aware, when they are made by competent persons and properly taken care of, that they require any examination; the only danger that results from the use of machinery, is the danger of the boiler's bursting, and in a low-pressure engine I have never seen or apprehended any danger from that cause.

2118. Have you made a number of vessels for the Channel?—Yes.

2119. How long have you been in the habit of making them?—For 14 years.

2120. In that time how often have you found your vessels return to you to repair or to renew?—It has only occurred in the case of having new boilers to put in.

2121. In what space of time has that occurred?—Generally three years.

2122. You are speaking of iron boilers?—Yes.

2123. How long would a copper boiler last?—I do not know, I have not had any experience with those.

2124. Are those boilers at work every day?—Every day, passing across between Dover, and Calais and Boulogne, and in other parts of the Channel.

2125. Have you not an invention that gets rid of the salt?—I am not aware of any invention; changing the water is the only way of preventing its accumulation that I know of.

2126. What is the shortest period that you would venture to say you could stop a vessel?—That would depend upon the vessel; it would depend upon the particular circumstances of the case, the relative proportion of the power to the resistance of the vessel, the paddle surface, and other things.

2127. What mode would you consider the best for reducing the power of the engine one-half?—There is no way but that of shutting the throttle-valve and shutting off the injection; that is the ordinary mode of doing it.

2128. Would that do it with certainty so as to regulate it from nine to six knots an hour?—Yes, that would do it effectually.

2129. By merely shutting the throttle-valve, could you get an index that would regulate the speed from nine to six knots an hour, without reference to other circumstances?—No, I did not mean that, because I did not speak of any precise quantity. That is the only way in which it could be done at all. There is no other way in which the speed of the engine could be stopped at all.

2130. That is not then a correct index to regulate the speed of the vessel?—No.

2131. Could the engineer, by management of the throttle-valve, reduce her, and in what time, to make that number of revolutions that would make her go six knots?—I think there would be a great difficulty in that.

2132. Will you explain that?—I am not aware exactly how it could be done with any great accuracy at once to come to any exact number of knots by that means; I am not aware how you could do it.

2133. You

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2133. You could reduce the speed?—You could reduce it by that means.

2134. When you reduce it, you are wanting to reduce it to make 18 revolutions, after she has been making 28; you have the means of examining the number that she is making; if you find that she is going 20 or 22, you still reduce her more; if you find that she is reduced to 16 or 18, you will let in more steam?—Yes.

2135. Therefore it would be a calculation of some time, but you know no other way but the throttle-valve?—No.

2136. When by the turning of the throttle-valve you have got her to turn 18 revolutions, would she go on steadily so?—Yes, I think she would.

2137. Would it not depend upon the fire?—Yes, it would; but at the same pressure, I mean with no variation in the pressure of the steam, she would continue to go at the same rate.

2138. Would it be possible to obtain that?—Only by experiment; an engineer would put a little steam off, and then he would put a little on, till he attained the desired speed.

2139. It must be an experiment made every time?—Precisely so.

2140. How long do you apprehend it would take a person to get to 18 revolutions from his 28?—It is rather difficult to answer that question.

2141. How soon could you do it yourself?—It would probably require three or four trials, because I must count for some time.

2142. What do you think of five minutes?—Yes, I think it might be done in that time.

2143. If the steam is fully up, can you in a low-pressure engine raise the steam above a certain point, if the safety-valve is equally charged?—No you cannot.

2144. If the steam is fully up, is not the safety-valve floating?—Yes.

2145. If the steam is fully up, and the engineer has ascertained by experiment that by turning the throttle-valve to a certain point he reduces the stroke of the piston from 28 to 18, would it not nearly have the same effect in the same quality of water?—Yes, supposing all the circumstances the same, and no difference in the draft of water, or anything else.

2146. You say it would take five minutes to do this; would it not be as rapid as the motion of the hand up and down?—Yes, I apprehend it would; that is supposing all circumstances the same; that the vessel draws the same water at all times, and no alteration in the case at all, as to the resistance the engine has to overcome.

2147.—Supposing the paddle wheel had to take a greater dip, would the effect of that greater dip not be to retard the number of strokes that the piston would make?—Yes, it would.

2148. Then if you are to reduce your engine from 28 to 18, you would require to count for that?—Yes.

2149. On the river Thames, are you acquainted whether steam vessels are not in the habit of being much more brought down at some times than at others?—Yes, they are, from the different number of passengers and cargo they would carry; and it appears to me an excessively difficult problem from that circumstance, I mean from the difference in the draft of water and dip of paddles.

2150. The vessels carrying passengers would not vary very much?—Not very much; I could not say with great accuracy as to that, but it would make a difference certainly.

2151. You said that the throttle-valve was the only mode of reducing the velocity?—Yes.

2152. Could you not supply some other means to reduce it?—I am not aware of any mode.

2153. Do you conceive any could be adopted?—No, I am not aware of any.

2154. Do you know of any mode, either by raising the shaft or by any other means?—Supposing you could do it in that way it would involve a great complication, it would increase the complication very much indeed.

2155. Are you sufficiently accustomed to steam-boats yourself to know in a common-sized steam-boat, say one of the Margate steam-boats, what effect upon her way each draft of water has with the same number of revolutions of the engine?—No, I am not prepared to answer that question.

2156. Are you aware, taking a Margate boat, which carries about 400 or 500 passengers, if she navigates with 200, what difference it makes in her speed of going?—No, I am not aware of that; I cannot answer that question.

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2157. With the engine that is usually employed in those vessels, does the safety-valve, being on the lift, show that she is exerting her utmost power?—No, it does not show the power at all.

2158. Does it show the utmost power which the engineer thinks it safe, with that engine, to use, with reference to the safety of the boiler as to explosion taking place, that the safety valve is weighted to the utmost power which the engineer thinks it safe to allow?—Yes.

2159. Do vessels usually work with the safety-valve upon the lift?—Almost always; they use all the pressure they can get.

2160. Then they have no spare power to use on emergency, without passing that limit which an engineer thinks the limit of safety?—No, they have not.

2161. Do not such emergencies frequently happen where it is requisite to use greater power than the average power she is using?—No, I am not aware of that; it is sufficient for common purposes; with vessels going to sea in a gale of wind, they might find more power useful then; but, speaking of river vessels, the power that they have is sufficient for all purposes of safety.

2162. If the throttle-valve be fully opened, and the safety-valve be on the lift, is the engine then at its utmost power?—Provided the barometer is standing at its greatest height at the same time, because it is not the pressure of the steam so much as the vacuum that produces the power; there is much less power produced by the pressure of steam than by the vacuum, so that it is necessary to know what both are.

2163. Can you state what is the variation in the degree of vacuum when the air-pump is under water; when an engine is working with the throttle-valve fully open, the safety-valve on the lift, and she is working in order, what height would the barometer be to produce the greatest effect?—That varies with the difference of pressure of the atmosphere; in ordinary cases it will be from 27 to 28½ inches of mercury.

2164. Could you conceive an index being formed, which being attached to the throttle-valve, would under all circumstances, by being moved, regulate the speed of the vessel?—Yes, supposing the resistance the same.

2165. The question refers to vessels on the river; could you conceive an index being attached to the throttle-valve, which would under all circumstances show the speed?—The difference in the number of passengers would create a difference in the dip and draft, and therefore you cannot do it with entire accuracy.

2166. Such an index would require to be regulated at every voyage and at every change relating to the vessel?—Unquestionably, to determine the question with extreme accuracy.

2167. Would not the extra depth of the paddle correspond very nearly with the extra draft of water which the vessel acquired by an increased number of passengers?—Yes, there would be an increase of dip of the paddle, and an increase in the draught of water of the vessel; they would both operate against the speed of the vessel.

2168. When the boiler is sent in to be repaired, how do you try the pressure of the boilers?—We do not consider it necessary with a low-pressure boiler to do anything of the sort, because it is much stronger than the strain to which it is subjected.

2169. Have you ever made any high-pressure boilers?—Not for steam-boats engines.

2170. At what point of pressure on the piston to a square inch do you regulate?—It is very different from the pressure in the boiler, if the engine is not well made; the pressure in the cylinder will be much less than in the boiler.

2171. On the whole what should you consider the highest pressure?—The engines used in Cornwall, which are called high-pressure engines, do not use, I believe generally, a greater pressure than 15 pounds to an inch on the boiler. It depends very much upon the degree of pressure in use in that district where they may be employed. In America, for instance, where a great pressure is employed, they would consider that a low pressure.

Mr. Joshua Field, called in; and Examined.

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2172. ARE you an Engineer?—Yes.

2173. Are you in the habit of supplying a great deal of machinery for the steam-boats?—Yes.

2174. Both for the King's, and also for the merchants?—Yes.

2175. Are you of opinion that any regulated pace could be ascertained on board of a steam vessel, with reference to the number of revolutions that the steam machinery makes, or by any other means that strike you; that is to say, supposing that a vessel at her greatest speed makes 28 revolutions, could it be ascertained by the reduction of those revolutions to 18, that she was going at a certain speed?—I think an approximation might be made by experiment.

2176. That is always providing it is smooth water to the same description of pace?—Yes.

2177. Do you apprehend that it would make a great difference, whether she had many passengers in or few?—It would make some difference; but I cannot speak to the precise difference. I never tried the experiment accurately.

2178. The paddles would of course be immersed deeper if she got deeper; and provided that were not carried to a great extent, would not the one counteract the other, and the engine give the same number of strokes?—No, I apprehend quite the reverse; the greater immersion of the paddles would decrease the speed of the vessel.

2179. If she makes the same number of revolutions, will she go nearly the same pace?—Yes, all things being the same.

2180. Supposing that you find the greatest speed of your vessel to be 28 revolutions, as long as she is going 28 revolutions she will go nearly the same speed?—Yes, nearly so.

2181. You cannot always make her go that?—Not always.

2182. Therefore, when she is out of trim, you cannot go at the same power?—No.

2183. Could you not always get with a vessel in her best trim that goes 28, 18 out of her?—Always.

2184. Supposing it was found by experience that a vessel in her best trim made 28 revolutions, and that she was found likewise in her best trim to be going 10 miles an hour; and that, equally in good trim, when she is making 18 revolutions, she was going six miles an hour; keeping her at 18 revolutions, though it would take more steam to get her through water, would she not be going nearly the same pace of six miles an hour?—I think she would go nearly at the same rate, but cannot say accurately.

2185. If you keep the same steam on, in proportion as you get her deeper, you will diminish the number of strokes, and in that proportion will go much slower, rating the speed according to the number of revolutions?—I think the speed would be nearly the same, but it would not be quite the same.

2186. Within half a mile an hour?—I think it might.

2187. Are you aware of any experiment having been tried upon that?—No, I am not.

Mr. Charles Beer, called in; and Examined.

Mr. Charles Beer.

2188. WHAT are you?—I have been put on as extra clerk to the Steam Packet Office at Fenchurch-street, and I have been in the habit of going in steam-boats; I have been cashier in the steam-boats.

2189. You have been to Gravesend in a steam passage-vessel?—Yes.

2190. You went twice in the same vessel?—Yes, I have been several times in the same vessel.

2191. One time that you went you had 100 passengers on board, had not you?—Yes.

2192. And you were exactly two hours and a half going?—Yes.

2193. Did you not go again with 500 passengers, and were you the same time going?—Yes.

2194. Was it under the same circumstances with regard to the tide and wind?—Yes; the tide was with us, or we could not go in that time.

2195. As far as you recollect, were the circumstances of the tide and the weather nearly the same; was there any spring-tide?—No particular tide; no spring-tide.

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2196. Was

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2196. Was there the same strength of tide in both periods ; will you state what time of the tide it was, and what time in the day ?—I can do it by referring to my books at home.

2197. Did it strike you that the vessel went with a similar pace when she had 100 and 500 passengers ?—The question with respect to the tide I do not think that I can give an answer to. I am cashier of the Hero packet, and that makes me positive as to the time.

2198. Could you favour the Committee with a sight of that book of which you spoke ?—I will ask the question.

2199. For how long could you give us a report ; is there a log kept there, and an account of the wind, and so on ?—I do not know, but I should conceive not.

2200. Do you always start at one time of tide or one hour ?—One hour. Sometimes we are four hours and sometimes three and a half coming up, and we have it against us both ways.

2201. What do you allow the longest time when you are going to Gravesend against the tide ?—Three hours and three quarters.

2202. And when the tide is favourable ?—Two hours and a quarter.

2203. What power is the engine ?—Two 50-horse power.

2204. What is the size of the vessel in tonnage ?—I cannot answer that question.

2205. When do you consider you are full ?—Seven hundred we should carry ; we had 680 down to the launch at Woolwich.

2206. Do you always land persons at Woolwich ?—No.

2207. What is the greatest number you remember to have had in her ?—I think I am not at liberty to say.

2208. What is the least number you recollect to have made that voyage with since you have gone to and fro ?—Never less than 100 by this packet.

2209. Under the same circumstances, you have not observed a material difference in her going, whether she had many passengers or few ?—Not any.

2210. You said you did not know the tonnage ?—I do not know.

2211. How long have you been cashier of the steam-boat ?—About 13 weeks. I am not regular ; I am off now, which is the reason of my being here.

2212. What is the reason why you are not at liberty to state the number ?—I do not wish to give offence to any proprietor I am under, and I expect to go there next summer.

Mr. Joshua Field, again called in ; and Examined.

Mr. Joshua Field.

2213. IF you had the same number of revolutions it would not make a difference of above half a mile whether she had passengers or not ?—I should apprehend not.

2214. Supposing, that by reducing the speed of one that usually makes 28 revolutions to 18, that gave six miles, or within half a mile of six miles, with a variation of the number of passengers, would it be easy to convey that intelligence of the number of revolutions that that machinery is making to the deck ?—That might be done very easily.

2215. How often do you think it necessary that the boiler and the machinery should be examined in vessels that go to sea ?—They should always be attended by careful people, who would be constantly examining every part of the machine.

2216. But they would not require any examination by the makers, unless the engineer on board the vessel found something out of order, for two or three years. Is it usual to send boilers to you for repair in less than two or three years ?—About once in three years, unless in case of accident.

2217. An accident the engineer must know ?—Yes.

2218. And an accident of that kind would merely have the effect of impeding the vessel ?—Yes ; or in cases of leaking, lead to an undue waste of fuel.

2219. You are aware of the object of this Committee. Does anything strike you that you can give the Committee for their information ?—I am not aware of anything beyond sound vessels and good machinery, with careful people to superintend them.

2220. And a check upon them as regards the machinery, would be an examination of that machinery by a competent person once in three years, leaving the intermediate space with the engineer of the vessel ?—The boilers generally requiring to be renewed or thoroughly repaired, once in three years, which commonly leads to an examination and repair of the whole machinery.

2221. Would

2221. Would it not be necessary to have a more frequent partial examination, besides the engineer who has charge of it?—The more frequently examinations take place the safer.

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2222. How frequently would you suggest yourself that a partial examination with regard to the boilers should take place?—Perhaps once in six months.

2223. Are you aware of any additional means that could be adopted for a more certain checking of the speed than that usually practised?—There is nothing so easy and so obvious as partially shutting the throttle-valve.

2224. With reference to a partial examination once in six months, what kind of examination do you mean, because if a legislative enactment is made it must be made obligatory on all?—I apprehend there would be great difficulty attending it.

2225. What description of intermediate overhaul of the machinery do you allude to, when you say that an examination should take place once in six months?—As to the state of the boilers, and the general state of the engines.

2226. What description of examination besides that would you recommend; what description of persons?—A superior foreman in a manufactory, or a principal of a manufactory.

2227. Should you think it necessary that a superior foreman in a manufactory, or a principal in a manufactory, should examine a steam-boat once in six months?—If the engineer on board is a careful man he might be relied upon.

2228. You have a general knowledge of the way in which steam-boats are managed; are those men, who are engineers in those vessels, men that you could rely upon for three years?—Some are, but very few.

2229. Then you think that for the security of the public there ought to be an examination once every six months; is that your firm conviction?—It depends so much upon the men on board, that it is difficult to apply a general rule.

2230. Do not you consider that it would be very expensive, and even detrimental, to the owners and commanders of steam vessels generally, if they were obliged to have a foreman or a principal in a manufactory to certify every six months of the efficiency of the steam vessel?—Most of them have that.

2231. Therefore you do not consider it would be onerous?—I should think not.

2232. What is the expense of that each time, supposing it to be in perfect order and not to require repair?—It would be a few pounds; 5 *l.* perhaps.

2233. Do you not think it would be quite safe, so far as the public are concerned, to leave the frequency of examination to the proprietors themselves, who would have these partial examinations made, to discover any injury that might have occurred?—The owners of the best steam vessels usually attend to the state of their machinery for their own interest; I cannot speak of all.

2234. Previous questions have had reference to the point, whether there should be a legal enforcement on those proprietors to have a person to examine her engines; do you think that is necessary, or may it not be left to the proprietors themselves to ascertain whether it shall be necessary to examine her or not?—I should think it might be left to the owners of the vessels.

2235. Is it not within your knowledge, that the commanders have a competent knowledge of their vessels, and that they are in the habit of examining them from year to year?—Some of them have; but very few commanders are acquainted with machinery.

2236. Do you know any instances of the owners and engineers of the vessels neglecting the examination of their boilers, so as to produce danger?—I am not acquainted with any pointed instance of that.

2237. You stated that a partial examination should be made once in six months; should that partial examination take place, must there not be considerable uncertainty in the examination?—Yes, considerable uncertainty.

2238. In a partial examination of that kind, can you say that you could give an accurate opinion of the state of the boiler without taking it to pieces, or coming to the bottom of it?—In an old boiler I could not.

2239. Does it or does it not, in point of fact, happen frequently, when you take out boilers from a vessel, that they are much more worn than you expected?—It frequently happens so.

2240. With reference to the three years examination that you mentioned, did you not contemplate taking the boilers up and examining them fully?—Yes.

2241. Will you have the goodness to state what the expense of that to the owners would be; taking out the boilers and taking to pieces the machinery, to

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ensure that it is all in perfect order?—That amounts to a general repair of the machinery.

2242. What would be the expense of that, supposing at the expiration of three years you thought that it was as long as the boilers and the machinery would generally remain secure, and that therefore you were to examine her; and, supposing such a thing possible, when you come to examine her, you find she is so well managed that she does not require repair, but you would take up the boiler, supposing it to be bad; in such a case what would the cost be?—The boiler would not be taken out, unless it were known to be bad.

2243. How should you proceed?—The owners of vessels seldom repair their boilers until it is absolutely necessary.

2244. Supposing that it was enacted that it was necessary at the expiration of every three years that the machinery and the boilers should undergo a thorough overhaul by a competent engineer, and you were called upon to examine it, and to declare whether it was in a perfect state, or what it wanted, how would you proceed?—We are never called upon to make that examination without repair being necessary.

2245. Supposing a captain who was going on a foreign station calls upon you to go on board his vessel to examine the machinery, to see whether it is quite perfect, he not discovering any defect himself, what would you do?—If he was going on a foreign station, it would be necessary perhaps to repair the boilers, although she might run another year at home.

2246. The question refers to the manner in which you would examine; how would you proceed to examine the boilers in order to entitle a person to a license?—By going inside and having every part cleaned and scraped, and every rivet examined.

2247. If you found that all perfect, would you be satisfied that she did not want anything?—Yes.

2248. Would you examine the shaft and the machinery?—Yes.

2249. Having examined every thing, and found every thing perfect, you then report that it is in a perfect state to go abroad; what would be the expense of that examination, say of a 400 ton vessel?—If it were merely such an examination, I should think it would cost from 10*l.* to 20*l.*

2250. Supposing your house, for instance, was selected by the Custom-house to make an examination of that description once in three years, on every steam-boat that came to London, do you consider that you could undertake that description of examination, setting aside all idea of repair, at a cheaper rate than 20*l.*, having so many to examine?—Yes.

2251. Do you think you could venture to say it could be done for less?—I think not.

2252. Could you examine the bottom of the boiler, and try all the rivets without lifting it?—Not the very bottom; the interior of the flues could be examined, but not the bottom.

2253. You could not answer that the bottom of the boiler was good without lifting it?—No.

2254. You would then require the boiler to be lifted to make your report?—Yes. The examination I alluded to is only applied to those parts which are accessible; the very bottom of the boiler is not accessible.

2255. Is it necessary that it should be accessible to know whether it is in a perfect state?—It is very desirable that it should be so.

2256. If the captain of a vessel is going abroad, and wishes, previous to his going abroad, to know whether she is in a perfect state, and to get a certificate, is it necessary that the bottom of the boiler should be examined?—That is the case.

2257. In order to certify to a captain, that every essential part of the machinery is good, what would you do if so employed; and what would be the probable expense in a vessel of 400 tons, with 100 horse power?—Such a complete examination of the machinery would require that the boiler should be lifted, that every part of the engine should be taken asunder, and every part minutely examined, and that would be attended with very considerable expense, and a great deal of work.

2258. What would be the expense?—I should think, in a vessel of two 50 horse powers, supposing there should be found nothing to do to it but to take it to pieces and put it together again, it would cost 200*l.*

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2259. In what ratio would that sum be increased if it were 200 horse power instead of 100?—Perhaps it would be 300 *l*.

2260. Do you conceive that that is necessary to be done once in three years?—From three to four years, I conceive, it is necessary.

2261. You mean to say, that if you examined a vessel after three years service, in this complete way, at the expense of 200 *l*., that vessel would be safe, if there was a good engineer, to take to any foreign station for three years before she came back?—I do not exactly think so; after three years the boiler would be deteriorated, if not worn out.

2262. How long would you insure a boiler?—The system has hardly arrived at that point; they are exposed to many casualties.

2263. This of course applies to boilers with salt water in them?—Yes.

2264. How long do copper boilers last?—Their duration has not been found in proportion to their expense.

2265. In point of fact, as far as your experience goes, your opinion is, that at the expiration of three years you would find the boilers either so deteriorated as to require new boilers, or that they would require a very considerable repair, which would not last three years?—Perhaps two years after.

2266. Two years after is all you can hope to make them last?—Yes, with constant service at sea.

2267. You would have no apprehension to send out that vessel to ply for two years before she was seen by a person in the habit of making or inspecting boilers?—Exactly so; that has taken place; vessels have come home from a foreign station, after three or four years working, and have gone out with their boilers repaired, and have lasted two years after that.

2268. Then an examination would not be sufficient every three years, but it would be necessary to have it every two years; because, although it would last three years the first time, the second time it would last only two; would not that be so?—It would, in that case.

2269. When you stated, in reply to a previous question, that the expense would be about 200 *l*., did you include the charge of putting the vessel into dock?—It would not be necessary to put her into dock to lift the boiler out; I did not include that.

2270. Do you include the charge for taking up the deck, and the shipbuilder's work?—No, I confine it to the engineer's examination.

2271. But there would be other expenses?—There would be other expenses.

2272. Although the Committee understood you to say, that you could not with safety run steam vessels for more than three years, could not you ascertain, in the intermediate time, by an external examination of the boilers, and an internal of the flues, whether she was safe for passengers?—Yes.

2273. How long do the vessels run on the Thames river?—They will last for four years.

2274. With respect to those vessels that have been in the habit of supplying the King's service, where no doubt you put the best work upon them, how long have you found their boilers last?—From three to four years.

2275. Can you repair them at the end of that time, or do you put new boilers?—We put a new boiler in at the end of three or four years, and we repair the old one against the second new one is worn out, to prevent detention to the vessel.

2276. With regard to the boilers, what is the practical number of pounds to the inch pressure that the low-pressure boilers used for steam-boats will bear?—We usually work them at three pounds.

2277. Do you make any that will work more with safety?—We have gone as far as five.

2278. How high could you prove those?—We have proved some up to 10.

2279. How many pounds to the inch would you allow for fair condensation of that description of engine which is usually put on board a steam vessel?—About 11 pounds.

2280. Is that merely for condensation, taking that by itself?—I suppose that a mean throughout, the whole stroke would be from 10 to 11.

2281. Then an engine that bears five pounds to the inch would bear an increased power of five?—Five in the boiler will not release more than three in the cylinder.

2282. Then both together would be 14?—Yes.

2283. If that is the mean which you have stated, what do you believe the real condensation that they usually get fairly from that part?—I should think it would

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be nearly as I have stated ; I speak of good engines ; there are some inferior of course.

2284. The index you referred to in the previous part of your examination had only reference to the revolutions of the shaft?—To the revolutions of the shaft.

2285. In decreasing or increasing the steam you open or shut the throttle-valve ? Yes.

2286. Do you think if it were fully opened, and then closed to exactly half the entire area, you could get an exact measure of the decrease of the velocity of the vessel?—You would get an exact measurement ; but I am not prepared to say what that would be.

2287. Could you, by the mere circumstance of knowing that you had closed the throttle-valve one half, know that you had decreased the speed of the vessel one half?—No, not at all.

2288. You were asked whether, if 28 revolutions gave 10 miles, and 18 revolutions in ordinary cases gave six miles, if from overloading the vessel the revolutions were reduced to 18, she would go six miles ; did you give that as your belief, or have you any cause for knowing that such would be the case from any experiment you have made upon the subject?—No, only as an opinion, not having made such an experiment.

Mr. Oliver Lang, called in ; and Examined.

Mr. Oliver Lang.

2289. YOU are a Master Shipbuilder?—Yes, at Woolwich Dockyard.

2290. Are you aware of the scantling with which steam-boats that formerly ran upon the River were built?—Yes ; I have seen steam-boats that were formerly built ; they were built on a very light plan. The first instance of steam-boat, the London Engineer, was very slightly built ; the timbers were so slight you could see the day-light through them ; they were in a very improper manner.

2291. And in a way you would not certify to be in a proper condition?—Certainly not.

2292. Are you aware whether many steam-boats are built now in that manner ? Not quite in that manner, but too slight I consider.

2293. Therefore if they came aground they would give way?—They would.

2294. When strong vessels would not?—Our vessels would not ; they have been on shore repeatedly.

2295. Do you think that the vessels which ply from London to Margate would require such timbers as would be required for a man-of-war?—If you were sure that they would not go any further than Margate, they are sufficient for that purpose, but I do not think they ought to cross the Channel

2296. Ought they, in your opinion, to be as strong as the sea-boats?—Yes, if they are liable to go to sea ; to go to Calais, they ought to be as strong as ours.

2297. The Margate steam vessels are frequently prevented from putting their passengers on shore at Margate, and are compelled to go round to Ramsgate ; under such circumstances ought they to be as strong as a sea-boat?—It is a short distance, but it is sometimes rough weather off Ramsgate.

2298. If you were called upon to certify to the Custom-house that a vessel was sea-worthy, to carry passengers from London to Margate, and altogether fit for that duty, would you refuse to sign a certificate to that effect if she were not built with a stronger scantling as the steam-boats built for the sea?—I should reduce the scantling a little ; but I think for a river they ought to be as strong as they are now.

2299. Supposing a vessel to be built of that strong scantling, which you consider to be necessary to enable you to give a certificate to the master of her that she is fit to carry passengers between London and Margate, how long do you consider, from your knowledge of the description of the timbers used upon the average in merchants yards, that that vessel would be safe for running that duty before it would be necessary to have her thoroughly examined as to the state of her timbers to insure her security?—It depends greatly upon who builds her.

2300. Speaking upon the average?—I cannot say unless I know the build of the vessel ; if I saw the vessel built I should know.

2301. If you see the vessel yourself built, and you see the description of timbers, and examine her when she is launched, and find that the timber is apparently sound and good, and that it is filled in a way that may be right, or that she is lined with a strong lining, and you are satisfied in your mind that she is as strong as necessary, and

and that she is built of fair materials, how long do you think you could give her a certificate for running between London and Margate, provided no accident took place?—I would look at her slightly in three years, or from that to four years, but I should not go into any thorough examination unless I saw any signs of weakness in the vessel. If I saw that the vessel did not show any weakness in her fastenings I would not examine her. I have not examined the Comet steam vessel, because she has not shown any symptoms of weakness; if she had shown any signs of weakness, and had been on shore several times, I should have some cause to examine her, because she would evidently show me some sign if she were weak.

2302. Supposing that a vessel of that description had a partial dry-rot in her timber, which had begun at the end of two years and a half, and you are called in as a periodical surveyor of that vessel, at the end of three years would she, because she had a partial dry-rot in her timbers, show a sign of weakness to warn you that such was the case?—Yes, I think she would, because the bolts would show, the treenails would show, they would be starting from the vessel's timbers, decaying under them.

2303. At the moment?—No, not at the moment, but when she becomes dangerous. I have not found one defect in any steam vessel I have examined.

2304. Do you suppose that they are not liable to that disorder?—Not having for the last 10 years seen that defect in them, I cannot otherwise account for it.

2305. It was stated yesterday in evidence that a vessel which appeared in a perfect state was bought, and cut in two in order to lengthen her, and they then found that most of the timbers in the wake of the engine were quite rotten?—She was not built upon the principle that ours are. We have an opportunity of seeing the timbers every day; but if so be that they were covered with ceiling, I would agree in saying, Examine them every year. The timbers are all clear in the diagonal work; the timbers are covered by the diagonal work in part, but the angles between are all open to view.

2306. Are they not filled up?—No.

2307. Is there not a surface over the whole?—There is a little fur over the engine room, and that is taken out to be looked at.

2308. Do not you see them in the engine room?—Not in the engine room; but forwards and aft you may see them. The engine room I have examined repeatedly, and I have never found a defect. The Messenger and the Hermes were purchased into the service; they were suspicious of those vessels, and they said they were weak vessels. I saw the building of those vessels, and after three or four years we dubbed the timbers, and we found them as perfect as could be.

2309. How long ago did you examine them?—About 12 months ago, when we purchased them.

2310. How long will it be before it will be necessary again to examine those timbers?—I should think it would not be necessary to examine them. We can look at them every day; we can take out a piece of fur and see that the timbers are all right. I should not have the least suspicion of her, unless she showed me signs of weakness.

2311. How long had those vessels been built when you looked at them?—About three or four years. We examined them because we had to purchase them for the service, and I found them entirely perfect.

2312. What examination would you consider, in order to give security to the public, steam vessels that proceed to sea should undergo; those that are built upon that principle of which you have spoken, and those that are not built upon that principle?—Those that are not built upon that principle I should examine every year, because I have seen so much of those vessels; the external appears very good, but the inside is quite rotten. It would be necessary to take out some pieces and examine them.

2313. Are not most of the steam-boats built in that way?—Yes. I believe some have come into the diagonal work.

2314. If the vessels were examined, like the Hermes, at the end of three years, would it be necessary to look at her every year?—Yes; I should be suspicious of them; I should like to look at them every year. It would depend upon how I found her at the last survey; if I found no symptom of defect, it might not be necessary.

2315. If she had been running about a couple of years, and you found no symptom of weakness in her, do you consider it would be necessary to examine her at the end of every year?—Yes, or at the end of two years; because I know that they are very deceiving, in men-of-war particularly. If she was built of American tim-

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ber or foreign timber, I should look at her more minutely ; I would not allow that in the building, because we have seen the evil of it ; I moved the whole ceiling of a frigate, the Immortality frigate, a French frigate ; I was in the hold with the people ; she had not been launched six months, they said, when we took her ; I was standing on the vessel ; I fixed a crow-bar into her, and I felt myself move, and I saw the ceiling giving way ; I took a mallet and moved all the lining inside ; I took out the nails with my finger and thumb ; I immediately ran her into dock. The ceiling was only half an inch thick, and the rest you could crumble with your hands ; the timbers had gone to a powder.

2316. It was only six months old ?—Yes, it was perfectly new, and bright and fresh. I never saw such a circumstance ; the people ran off the ship as fast as they could when I took out the nails, quite frightened ; it was a most frightful sight. That was the Immortality ; she was broken up directly ; and ever since I have had a doubt upon ships, and always had the planking upon both sides.

2317. Do you apprehend that the timbers that were put into the Immortality were ever in a state that you would not have known that they were liable to decay ?—I think they were put in green.

2318. You would therefore have observed that ?—Yes ; I should not have allowed it.

2319. You would have been quite aware if you had surveyed those timbers that they were improper to have been put in that situation ?—I should.

2320. If a vessel has been in use for a couple of years, which would give time to those faulty parts to show themselves, and you found that the timber was sound, and fit for the purpose of strengthening the vessel, would it be necessary, for the safety of the passengers, to put her to the inconvenience of having her lining opened and having the same process gone through ?—It would depend upon the vessel.

2321. If you found her perfectly good ?—She might run two years, but it is very suspicious.

2322. Is there not a material difference between a measurement of tonnage and the tonnage actually carried ?—Yes, very great.

2323. What is it ?—It depends upon the formation of the ship ; I cannot tell what.

2324. Can you exemplify it in any way ?—By adding greater depth to one vessel than to another ; they would be the same tonnage ; you would gain more tonnage considerably than she would measure, and you might increase it almost to anything, and reduce it by the figure of your vessel.

2325. Suppose you were to build a vessel which should be registered at 200 tons, by any particular form of building how many tons could you possibly build her to carry ?—I cannot say.

2326. Could you double her tonnage ?—I should suspect we might.

2327. What is the difference you have known between the measure of a vessel and her capacity ?—I can hardly say.

2328. Do you not know that the 1,200 ton East Indiamen are supposed to carry 1,500 ?—I have heard that.

2329. With regard to steam-boats, is there as much variety in them ?—Yes, as much variety in them as in anything. In merchants' tonnage they take out the engine room, but in the Government ships they do not. Our tonnage is the whole of the vessel, engine and all, but in a merchant vessel it is without the engine.

2330. The object being as to the number of passengers to be carried, do you consider that the general build of steam-boats for carrying passengers varies so much that you could not fairly apportion the number of passengers to the number of tons ?—I do not think they differ so much as that ; the measurement would give you room to store the passengers.

2331. What do you think would be a fair compensation to make for this sort of annual survey, supposing there were to be an annual survey ?—It depends upon the extent of the survey.

2332. If there were to be an annual survey, whether there were to be little or much to be surveyed ?—It would depend upon the quantity done in the survey ; whether it was necessary to remove a plank, or merely to look at the vessel. It would depend upon to what extent it was carried. We cannot judge of that till we see the vessel ; it may cost a mere nothing to look at her, and be satisfied that she is safe. I built the first steam vessel to remain at sea during the winter for the Post-office ; that was in 1819 or 1820, near Rotherhithe ; it was said that it was impossible to build a steam vessel that should continue at sea a winter ; there were

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two vessels running at that time, the and the Ivanhoe; the other vessels gave up for the winter; when the and Ivanhoe came, they ran the whole time; the other vessels could not stand it. From that time it has gone on, and we have continued it; and I have not seen a vessel show the least sign of weakness; and I have had a great number to do with; she has kept her form, and preserved it well during the whole time.

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Sic in orig.

2333. What was the difference of strength between those that continued in the winter and those that gave up?—Those that put up during the winter were built with the fothing inside, and the planking outside; the timbers concealed under the fastenings moved, and the ships became leaky in heavy water, when the sea was running; they could not stand the sea; their apartments we thought would have been lost; in fact they could not continue it, and they were obliged to give it up. Those vessels were built with a hog; you would know them by the form; all the others are hogged that are built in that way.

2334. What is the expense of building them?—I think the expense is very little, because it is only put in a different position.

Mr. Jacob Perkins, again called in.

[The Witness produced a model of the largest steam packet in America, which was examined by the Committee.]

Mr. Jacob Perkins.

Mr. James Ballingall, called in; and Examined.

[The Witness produced various models for the improvement of all vessels with regard to safety, durability, and protection to cargo from fire and water, in case of accidents at sea, which were examined by the Committee, and, so far as they were inspected, were approved of.]

Mr. J. Ballingall.

2335. YOU have been accustomed to the sea, have you not?—Yes; I am a seaman.

2336. Are you a ship-builder?—No.

2337. Are you accustomed to steam-boats; have you had any considerable opportunities of observing their construction and defects?—As a passenger I have.

2338. In what particular situations principally?—Principally on the Firth of Forth.

2339. Is it your opinion that steam-boats are generally built with sufficient attention to strength and public security?—Most unquestionably not.

2340. Do you remember any particular instances in which accidents have happened from neglecting those points?—I do not recollect instances where there have been actual losses, except the Rothsay Castle and the Frolic; not cases certainly which have come under my own cognizance, but which I have seen, from the public papers, to be particularly defective.

2341. Are you of opinion that it is desirable for the public protection that some measures should be adopted to insure their construction with more strength, and greater attention to public security?—Yes, I am.

2342. Do the models which you have now exhibited, and the modes you propose, arise from your having observed that steam-boats are defective at present?—They do so. I have no object in presenting those models but to make them public.

2343. Have you built any vessel upon this principle?—No, I have not.

2344. Have you anything else to state to the Committee which you think would be useful for them to know, to promote the object they have in view, which is to prevent danger to the public from steam-boats?—There is nothing which I can suggest further than the necessity of having periodical surveys of all steam vessels. I consider it should be enacted, "that all steamers should be filled in solid in their bottoms and sides, to above the line of load-water floatation;" that were the Commissioners of the Navy to announce publicly, in any manner they might think proper, "that having had 21 years' experience of the beneficial effects of solid bottoms in the ships of His Majesty's Navy, in point of strength and safety, they would give a preference to vessels with solid bottoms, when steamers, transports, or hired vessels of any description, were required;" it would have a beneficial effect.

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2345. You,

Mr. J. Ballingall.

29 September,
1831.

2345. You, as a practical man and part-owner and manager of a shipping company, which carry on a considerable trade, see no inconvenience in such regulations being made?—None whatever, I think they would be beneficial to the public.

2346. Do not you think it would give confidence to the service?—Yes, I think it would do good to steamers.

2347. Do you see any difficulty in that being done by the collector of the customs employing persons at any port?—None whatever.

2348. Do you consider that the expense would be a burthen?—I think the expense would be cheerfully paid, even by the owners of steam-boats, though the policy of the owners paying might be exceedingly questionable.

2349. How would that, in your opinion, be effectually done where there was not an opportunity of having a regular surveyor; for instance, in some of the inland towns; can you suggest any way in which the person appointed might obtain any tolerable information; supposing, for instance, it were a carpenter?—It is a question whether he might be of sufficient rank to be beyond partial influence; but I would suppose some such person as an officer of the Navy; anybody who knows anything of steam-boats can easily see when they strain.

See Appx. No. 6.

[A Letter from Captain Kennett B. Martin to the Committee was delivered in and read.]

Veneris, 30^a die Septembris, 1831.

Mr. John Chippingdale, called in; and Examined.

Mr. J. Chippingdale.

30 September,
1831.

2350. YOU are a Pilot, are you not?—Yes.

2351. You have been in that employment many years?—Thirty-five years, come next March.

2352. Where?—Trinity pilot.

2353. Do you consider that many of the accidents that have occurred have been owing to any improper mode in steering in the boom, on the part of the vessels generally?—As respects ships under convoy, there is seldom anything of that kind occurs, except where the craft comes in contact with the ships; but with regard to the danger from ships, I should apprehend it is from having too much way.

2354. Should you recommend any improvement, or any mode by which those dangers might be avoided?—My decided opinion is, that the steam-boats should not enter the Pool at all, if it is possible to avoid it.

2355. Why?—In consequence of the velocity of her way through the water.

2356. Then you have observed them?—I have, repeatedly.

2357. Is there a good deal of racing?—I do not know: they are running at full speed, or two thirds speed.

2358. What rate should you consider full speed?—I should suppose nine knots.

2359. And that you consider more than they ought to go?—Yes.

2360. And, of course, likely to produce considerable danger?—Yes; the resistance of the vessel in the water causes the swell: it is not the paddles that cause the swell, it is the resistance of the water to the bow of the vessel.

2361. Have you yourself witnessed any accidents from steam-boats?—Not many; I have seen some.

2362. Then you think it is not from running down the craft that the accidents have happened?—No, but by the swell from the bow.

2363. You state, that the accidents that have occurred in the Pool, and the inconveniences from steam-boats, arise from their having too much way?—Generally speaking.

2364. In your opinion, they should not enter the Pool at all?—I think they are too large to enter the Pool.

2365. You were asked, why they should not enter the Pool? you say, you think they should not, because they go so fast: but if they were prevented from going so fast, if they were restricted to going a moderate speed, do you think they ought not then to be allowed to enter the Pool?—It would be required then.

2366. If

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2366. If they were prevented from going faster than six miles, would there be any danger?—I should think six miles too fast. *Mr. J. Chippingdale.*

2367. How much would you allow?—Not more than four.

30 September,
1831.

2368. Do you think a vessel of 100 feet is manageable, going only four knots an hour?—She is equally manageable; but it is a great length in the Pool.

2369. If you had the tide running three miles an hour, and the vessel was going only four miles, would the vessel steer to any purpose?—She will steer; it is no consequence whether the vessel is going or not; she will not answer so well if she has one knot way, but quick enough to prevent damage.

2370. You have spoken of large boats; in point of fact, do not the small boats do as much mischief in passing through the Pool as the large boats?—I should think not.

2371. Do you give that opinion from your own observation?—From my own observation; I have always observed that the swell proceeding from a large boat is much more dangerous than that from a small one.

2372. From that you consider that it arises not from the paddles?—Yes; the paddles may increase it some little, but the swell is caused by the resistance to the bow of the vessel.

2373. Do you consider that a vessel not going so fast would produce the same effect?—No, there is no doubt that the paddles increase it; but that is not the primary cause, I consider.

2374. You consider it is by the bow displacing the water that the swell arises?—Yes.

2375. Will you describe to the Committee the effect of that?—The resistance of the water at the vessel's bow then separates the sea, and causes two swells. To make use of a simple idea, it is something like a lady's fan opened, and spreads as it goes on, and this swell comes into the boats, and causes them to sink in the water.

2376. It causes a wave on each side?—Yes.

2377. Have you seen any boats swamped?—I have not seen boats swamped, but all but swamped, particularly laden with passengers, shipping a great deal of water.

2378. Your opinion you give, that vessels should not enter the Pool at all, is from your idea that the evil cannot be sufficiently prevented otherwise?—Not sufficiently.

2379. If they are restricted to four, would not that get rid of the danger?—It would lessen the danger, but not entirely remove it.

Martis, 4^o die Octobris, 1831.

Captain Frederick Bullock, called in; and Examined.

2380. YOU have been employed of late years surveying the river Thames?—I have. *Capt. F. Bullock.*

2381. How long have you been employed upon the river Thames, and attending to it?—I think the whole of the five years in the steam vessel; I commanded and all. *4 October 1831.*

2382. Have you in the course of that time turned your attention much to the tides?—I have measured them constantly, and particularly last year.

2383. Will you be good enough to state to the Committee, from those observations which you have made, what you consider the average rate at which the ebb and flood tide runs at spring tides through the Pool and that part of the river?—It has never exceeded, by my observations, in spring tides, three miles an hour; it has been two.

2384. Which runs the strongest, the ebb or the flood?—The ebb; I speak of the strongest tide, it never has exceeded three miles.

2385. Statute miles, or geographical?—Geographical; my log measure is geographical miles.

2386. What has the flood run?—The flood has run two miles and a half.

2387. Do you speak of the strongest tide you ever witnessed?—The strongest.

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2388. Is

Capt. F. Bullock.

4 October 1831.

2388. Is that an ordinary spring tide?—It is considered an ordinary spring tide.

2389. Have you never experienced in the course of the five years you have been employed, an extraordinary rush of tide?—Never in the tide I have measured.

2390. What do you consider the water to run under the bridge?—The utmost I measured was 10 miles.

2391. When it was going 10 miles under the bridge, what was it running below?—Two miles and a half.

2392. At what distance from the bridge?—At the Tower stairs, in the stream opposite the Tower stairs, about 500 yards.

2393. What was it going above the bridge at that time?—Two and a quarter; it did not give me the same result exactly as below bridge.

2394. What distance from the bridge was that?—One hundred feet above the bridge.

2395. Does not the river rise about 17 or 19 feet above the bridge?—Nineteen.

2396. How long does the ebb run?—About six hours and a half to seven hours.

2397. How long does the flow run?—About five hours.

2398. If it rises 19 feet in five hours, ought not that current to be stronger than when it goes down in seven hours?—No; during the flood there is a great accumulation of back-water, the water is kept up that runs from the country; it is therefore that the freshes are still faster. There is always an accumulation of water above the bridge, that accumulates with back-water from the country, which makes up those differences, and it will be faster with those freshes, though I have never measured, but I believe that during the freshes, or the land water coming down, it runs with greater velocity.

2399. During the time you have been surveying the river, how often have you measured the velocity of the tide?—I have measured in the Pool, the whole year.

2400. Every day?—Every day during the whole year; very nearly every day, I will not say exactly.

2401. And you have never found the tide go more than three knots an hour?—Never; I have the register, which I can show the Committee if they wish; and it is astonishing, in neap tides, how slow it runs; barely one mile each way; in the Pool we have the greatest velocity.

2402. Is there any perceptible difference between the run of the tide in the stream in the Pool, and at Greenwich?—I imagine so.

2403. Where would it run strongest?—In a contracted space, decidedly.

2404. Have you proved that?—I think I have observations at Greenwich upon that, but I can hardly say.

2405. How broad is the deep-water channel at the Pool, as compared with the deep-water channel at Greenwich?—About one third.

2406. Which is the narrowest?—In the Pool; and if you take in the same time the contracted space of the shipping, it is much less still.

2407. How wide is the deep-water channel from Deptford to Greenwich?—I cannot precisely say; I do not recollect.

2408. You have surveyed it, have you not?—Yes; I have it upon my plan.

2409. Is there a wide deep-water channel there, or a narrow one?—Opposite Greenwich it is wide; a little below it is contracted again.

2410. At Deptford what is it?—At Deptford it is wide again; it is wide from side to side, and it is not interrupted from shoals.

2411. Do you find the tide slacker there?—Yes, it must be so.

2412. But in every part, however contracted the river, you have never found the tide run more than three knots?—Never; I have never observed the winter tide.

2413. From your general observations on points of this description, being a scientific person, and possessing practical knowledge upon the subject, what in your opinion, from what you have seen in the time of the freshes, and of the winter, would be the utmost rate the tide could run, under any circumstances, in the Pool?—I imagine it is half a mile more, but I am fully assured it could never exceed four miles an hour; I think considerably less.

2414. You have been employed by the Government lately, to make some experiments in the Pluto?—I have,

2415. Will

2415. Will you be good enough to detail to the Committee the nature of the instructions of the experiment you were to make, and the results which you found?—My instructions were as follows: “At what rate per hour, with how many revolutions of the machinery, can be obtained by the Pluto, in her proper trim; in the same trim, what reduction of the number of revolutions will cause her to go at the rate of six miles per hour; also what reduction of the number of revolutions will cause her to go at the rate of four miles per hour.” That is the whole that we performed.

2416. Will you be good enough to state the instructions you were under?—“Those points having been satisfactorily ascertained, you are to cause the Pluto to take on board from Woolwich Dock-yard as much ballast as will bring her down in the water five inches bodily, and you are then to try her again, in the first place to ascertain what difference her being so put out of trim makes in her rate of going through the water with her whole power of steam, and what number of revolutions are then obtained, and afterwards the steam is to be regulated so as to make the engine perform precisely the same number of revolutions as it did when she was going in trim six knots, and you are to ascertain whether there are any and what differences in the way through the water given by the same number of revolutions, in consequence of the alteration of trim. Having sufficiently ascertained this fact, you are to cause the same experiment to be tried with regard to the four mile per hour pace; after which you may try any other experiments of similar tendency, that Rear Admiral Adam, or any other gentleman of the aforesaid Committee of the House of Commons may request of you, and when entirely satisfied on the several points desired, you are to return in the Pluto to her former moorings.”

2417. Will you go on to state how much you executed of those instructions, the reasons why you did not complete them, and what were the results?—We obtained, in the first place, with a full power of steam, that the Pluto went at eight knots per hour by three logs, two patent logs, and the common log; we made several observations of this kind, and some that are not here.

2418. Will you have the goodness just to state what you did, and what were your observations?—After making those observations we closed the throttle-valve one-fourth of the power of the steam.

2419. Your first experiments were as to the variations of speed which were caused by the variations of the revolutions?—Yes.

2420. Will you state them as you made them, seriatim?—The first experiment was at full force, we then obtained 27 revolutions, and it gave us $7\frac{1}{2}$ miles per hour.

2421. Will you explain that; how did you prove that?—This was by Massey's patent log.

2422. And anything else?—Not the first. The second was the same power, and the wind ahead, a light breeze; we obtained $26\frac{1}{2}$ revolutions, and $7\frac{1}{2}$ miles per hour, the patent log giving us $6\frac{1}{2}$, which I think was a discrepancy, but I have put it down $6\frac{1}{2}$. The third was under the same circumstances; 26 revolutions, $7\frac{1}{2}$ miles by the patent log, and $7\frac{1}{2}$ miles by the common log. The fourth, the wind was then aft again, it was in our favour; we turned $8\frac{1}{16}$, $8\frac{1}{16}$ by the second patent log, and 8 by the common log; that we thought was satisfactory.

2423. How was the tide at this time?—This was with the tide; it was past high water.

2424. How many revolutions?—With 27 revolutions.

2425. Is your full speed 28?—Twenty-seven and a half; we have never gone more than that.

2426. That is the most you got the whole day?—Yes, and that was only for an instant, for directly afterwards we got 27.

2427. Both with the tide and against the tide?—No; it made a difference of some revolutions when we went against the wind; it made nothing; the tide; we tried it afterwards, once under the same circumstances, with the wind ahead again; that was the fifth, I think $25\frac{1}{2}$ and 26 revolutions, we had both, and $7\frac{1}{2}$ miles an hour.

2428. By the common log or the patent log?—By the common log; we then ceased the patent log as it took so much time.

2429. Had you got enough of experiments while you had the patent log out, to come to your conclusions?—We had four experiments which came near the

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common log, very near, the divisions were so small we were obliged to allow time; there was one or two that I lost. We come now to experiments by closing the throttle-valve: in the first experiment we closed the throttle-valve by the register one-fourth, by the lever $25\frac{1}{2}$ revolutions, seven miles an hour, under the same circumstances; this is with the wind ahead. We then closed it again to one-half, we obtained seven miles an hour by the common log, this is all by the common log, and $24\frac{1}{2}$ revolutions, the wind still ahead. We then closed it three-quarters, 23 and 24 revolutions, we had a little variation of seven miles, and the wind ahead still. We then turned the vessel, and had the wind aft; we closed the throttle-valve to half, and obtained 26 revolutions and seven miles and nine-tenths with the wind. It was then closed to the three-quarters, the wind the same, the wind aft, it gave us 24 and 25 revolutions, and seven miles and three-quarters. It was then changed to the full power; we were then changing our experiments to the full power with the wind ahead. We turned round again, and had the wind ahead; it gave us $25\frac{1}{2}$ and 26 revolutions with the full power, and seven and three-quarter miles an hour. The next was the reduction from full power to three-quarters closed, with the wind ahead. There was one-fourth of it opened, 22 revolutions and seven miles an hour, that was with the wind fresh ahead. It was then closed to seven-eighths afterwards, which is one-eighth open, producing 20 revolutions, and six miles an hour, with the wind on side. We then rounded the reach, and brought the wind ahead; it then produced $18\frac{1}{2}$ revolutions and six miles an hour.

2430. Were you perfectly satisfied in that last time, that she was going six miles?—I hove the log myself ever since the seven miles.

2431. Was not the patent log put over at that time?—Yes, it was; but that gave six miles; by the common log it was five miles and one-tenth.

2432. Was that the last experiment you made?—It was the last when the gentlemen of the Committee were on board. I tried going down to reduce it, we then reduced the power to what we thought four miles, we tried it by many experiments, and we had then 13 revolutions, but they were so unsteady that they produced from seven to 15 revolutions, only they were most on the higher, and we took 13 as the mean.

2433. Was that still done by the throttle-valve?—By the throttle-valve, as much as we could lower it, still giving it power. I hove the log several times to find how near she would go four knots, and the man was then attending at the throttle-valve, and opened and lessened the aperture as I called to him; and when I had attained that, we endeavoured to attain something with the revolutions, but we could make nothing of them at all, and they vibrated from seven to 15.

2434. Did the steam appear to be pretty equal at that time?—It was escaping.

2435. Which way was the wind?—We were then against the wind, we were turned round to come to our moorings.

2436. Did you keep her steady during that time?—No, it was only a short time that we could keep her steady, sometimes she was going three and a half, sometimes four and more, and five and six, all the time we were trying this; we tried to get as near as possible to four miles.

2437. You never got her steady to that time?—No, and when I spoke to the engineer about it, he always shifted it as if it was not fixed, he looked at it when I said that it was not going fast, he struck the lever, and changed the position; he appeared to have difficulty in keeping the lever itself steady to the point.

2438. What was the result of your first experiments as to the loss of the number of revolutions; what change of speed did it appear to make?—From $7\frac{3}{4}$ to $7\frac{1}{2}$ by the patent log; there is also one of $26\frac{1}{2}$ revolutions here, which gave $6\frac{1}{2}$ by the patent, and $7\frac{3}{4}$; that was an experiment we were not at all satisfied with.

2439. Did you happen to enquire whether the engineer on board the Pluto, was a man supposed to be of ability in that line?—I did.

2440. What was the answer?—The commander said he thought he was not an experienced engineer; that that engine was a very good one. It was dark in performing the last experiment; we reached our anchorage when it was dusk.

2441. And you were unable to make that experiment?—Yes.

2442. What is your general impression, from what you saw, of the power of regulating the speed of a vessel by means of a throttle-valve?—I should imagine in the present state of the engine, it is impossible to regulate it by a throttle-valve.

2443. Will

2443. Will you be good enough to state your remarks on the sea made by the vessel, when it was at its greatest and at its least speed, and so forth?—At her extreme velocity there was scarcely any wave, it was not a broken wave, it was a simple undulation, but we found it increase to half speed; it was the first time when it was decreased one quarter, that our attention was called to the undulation of the wave, we first observed it when we began to close the throttle-valve, it was more observable when we had the last, which is 20 revolutions.

2444. Was the wind strong or moderate?—Very moderate; it was a very light breeze; there was once or twice, that the wind was a little fresher than before; we observed it in lessening our speed, in turning as we did at the reach, alternately, more particularly.

2445. After the gentlemen had left her, and when you had reduced her speed, varying from three to six knots, at that period did she appear to have more sea, than when she was going seven knots?—Even then she had more sea, it was plain, but I do not mean to say that there was so much sea when she was going at that low rate, as at a certain extent, as when she was going 20 revolutions, the swell reached a certain point, and then it would lessen till she was at rest.

2446. What was the maximum of her sea, did you observe what revolutions she was making when there was the greatest sea?—I think the greatest sea I observed was, when her way was slackened, from the turning the reaches.

2447. When she was going fair, in the middle of the river, what was her maximum sea?—I think the most was in going up Greenwich Reach, at the rate of six miles by the patent log, and $5\frac{1}{2}$ by the common.

2448. How much steam were you using; how was the throttle-valve?—It was closed seven-eighths.

2449. How was the wind then?—Ahead.

2450. She was going 20 revolutions, but the whole time she still kept her six miles speed?—Yes.

2451. Which would she make the greatest sea at, 20 or 18?—She made the most disturbance then, except in that of the turning.

2452. Could you keep her steady at 18 revolutions?—I think she was steady at the 18 revolutions; I was more attending to the log at that time.

2453. You have stated, that the maximum of the sea was at $18\frac{1}{2}$ and 20 revolutions; do you consider, that as you increased from that up to 27 revolutions, you diminished your sea?—Yes, I think so.

2454. And when you decreased from 20 downwards, you then diminished the sea?—Yes; and I imagine, that she would diminish till she was at a state of rest.

2455. At your lowest speed, did the wave that was then left behind greatly exceed that which was caused by your highest speed?—Yes, and I think it was a different kind of wave, one was apparently an undulation, and the other was a ground swell, and broke, it was in a lesser degree, but it is an altered wave, it begins to change its appearance.

2456. Do you think the danger to boats crossing the wake of the vessel when at her lowest speed, would be greater than in crossing it at her highest speed?—Yes, I think that is the dangerous wave; the breaker when going at four miles an hour.

2457. Your opinion is, that the greater the velocity with which the steam-boat goes, the less is the swell?—Yes, to a certain point.

2458. As you decrease the velocity of the steam-boat the sea decreases?—Yes, to a certain point, it will decrease till it gets to a state of inertia.

2459. You have been in the habit of surveying the river for some time; have you remarked that the deep channel of the river has widened at all since the great introduction of steam-boats on the river?—We have nothing to compare it with; there was nothing ever known of its bottom before; my duty was to make a standard; I have sought in London at the Trinity Board, and I can find nothing to show the former depth.

2460. Some of the watermen have stated to the Committee that the effect of the steam-boats is to lower the strand, to wash off the mud; has your observation of the river corresponded with that?—I have not had time to discover, but then it is simply the surface which is washed.

2461. Did you take any notice as to the depths of water you might happen to be in?—At the time spoken of we were in deep water.

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2462. And yet there you made the greatest disturbance?—Yes.

2463. What rigging had the vessel?—She was as all steam-boats are, square-rigged forward, with square masts and yards.

2464. Were her sails up?—Yes, and a gallant yard across; the commander wished to know whether they would have it down, but they thought it was not of sufficient consequence to the vessel.

2465. Have you commanded a steam vessel before?—Yes.

2466. What steam vessel have you commanded, and for what length of time?—I commanded the Echo steam vessel nearly two years.

2467. Did the swell occasioned by the steam-boat when you were going nine miles an hour, arise from the bows of the vessel?—That which struck the bows went from the vessel in a different angle, this was right aft.

2468. When you reduced your speed to six miles an hour, and threw off a different sort of swell, did that leave the vessel at the same angle, and at the same part of the vessel?—I did not particularly observe; but to my experience it did.

2469. You have observed two descriptions of seas thrown from the vessel, one in her wake, and one from the bow and her paddle-wheel, will you describe under what circumstances of speed you had both those seas, was it when she was going at her fastest speed?—We saw it at both; they are both present at all times; but I am very much inclined to think that the one is increased with its velocity, that the outer sea which strikes the bow is increased by its velocity, and that is a breaker, it is that which reaches the sides of the shore, and makes the disturbance.

2470. It touches the bow, but hardly touches the paddle-wheel?—It falls on the paddle-wheel; it falls off from the paddle-wheel, it diverges.

2471. Is your vessel very short?—Yes, very short.

2472. Are the Committee to understand that there are two descriptions of seas, an undulation rather than otherwise, which comes from the quarter of the vessel, and that there is another sea, a breaking sea, which goes off from the paddle-wheel?—Yes, at an angle of about 20 degrees.

2473. Will you be good enough to describe which of the two seas, the one aft, or the one from the paddle-wheel, is the one that makes the disturbance on shore?—I should imagine from my observation, it is the sea on the side, because I have watched it till it reached the shore.

2474. And that in some degree accompanies her under any speed?—Yes, to the best of my observation.

2475. Does it not augment with the speed?—I think it does; I cannot recollect.

2476. You stated that when the vessel went about six miles an hour, it produced a breaking sea?—The sea in the wake falls a long way aft, and forms in the shape of breakers at a great distance from the vessel, but still they are in the wake.

2477. Was there ever any sea during the course of the day from the paddle-wheels, whether going slow or fast, that would have swamped a boat?—No.

2478. Was there a sea in the wake that would have done so?—Yes, there was; but I did not call my attention to that so much as to the other.

2479. Did you ever notice any difference in the speed of your vessel at the time you commanded her, whether you were in shoal water, if you were ever so situated, or in deep water?—No, not to examine her speed, certainly.

2480. How far astern do you think was the sea, when going at the rate of between five and six miles an hour?—I think between two and three hundred yards.

2481. Did that continue only in your wake, or did it roll to shore?—We could see it breaking only in the wake, and I have known it only in the wake. On the coast of Portugal, we used to see it breaking almost as far as we could see it, still astern.

2482. Do you not consider that the danger from steam-boats, is the angle thrown off which reaches the shore, and swamps the boats at the stairs?—Indeed I have seen the other so bad, that I cannot say.

2483. Does the other go to the shore?—No; I think that keeps an undulation in the centre, but it is a more dangerous one still than the other, except where it reaches the shore, and a boat is on the shore.

Veneris, 7^o die Octobris, 1831.

John Coxhead, Esquire, called in; and Examined.

2484. YOU were a passenger on board the late *Rothsay Castle*, were you not? *John Coxhead, Esq*
—I was.

2485. At what period?—On the 17th of August I embarked in her, in the morning, at 10 o'clock. 7 October 1831

2486. Will you be good enough to tell the Committee, as briefly as you can, the particular points as to what occurred from the period that you embarked; was not the *Rothsay Castle* a War-office packet?—She was; I saw the advertisement of her before I embarked; I did not look at the advertisement with that idea, to know whether she was a War-office vessel or not.

2487. She sailed under that denomination?—Yes.

2488. Will you state what occurred to the *Rothsay*?—I was at Liverpool; and I made up my mind to go on board a packet to go to Wales. I went on board with my luggage; I did not make any inquiries as to the description of the vessel; I merely looked at the advertisement the day before, and saw that a vessel was going at 10 o'clock. I went down at 10 o'clock, at the time of sailing; the hour fixed for sailing was 10 o'clock precisely, but at that time there were a few more passengers that wished to get aboard, among which were particularly Mr. and Mrs. Forster, and that took a good deal of time, the consequence of which was, that it did not sail till a quarter to 11 o'clock. It was rather an unpleasant morning; there was a great deal of wind; there had been a great deal of wind the evening before, in fact a very heavy storm, with thunder and lightning, such a storm as the inhabitants of Liverpool say they never recollected for many years. That would disturb the sea no doubt. I am not a nautical man, but no doubt it would have that effect.

2489. Was there a heavy sea at the time?—Yes, there was; and I attributed the disturbed state of the sea to that cause. I did not make any observation to any one upon it, as I was travelling by myself, and nothing particular occurred further till afterwards, in the afternoon, when the sea increased very much indeed, about three o'clock.

2490. Where were you at the time?—As far as I can recollect we were opposite a place called Abergelly; I think that was the name. The vessel had strained considerably before that period, but I attributed that entirely to the eddy motion of the sea, and to no other cause; but about three o'clock the motion of the vessel was very extraordinary, but I made no observation to any person, considering that it arose from that cause. We proceeded very slowly till we got to the Great Ormes Head, at about eight o'clock in the evening, about five hours after she had been at Abergelly; she had made very little way, sometimes not half a mile an hour, sometimes not moving at all; and from what little way she made she went back apparently, and we watched the points of the land, to see whether she did make any approach, but it was evident she did make an approach, because about eight o'clock in the evening she arrived at the Ormes Head. It then got dark, and I thought that there might be some little danger, and the passengers, some of them, insisted that there was danger; the wind was blowing very high, and they expostulated with the captain, to know whether they should go forward or not; but I did not join in this myself, because I was alone, and did not feel much disposition to be afraid. There were two or three elderly gentlemen that insisted upon his going back; he made a reply to that, that there was no danger, and that the little gale that was now blowing was only the tail of the storm that had existed the previous evening. I had not been below stairs the whole of the day myself; and the ship made so much motion, that we could not keep our seats, either in the fore-castle or the stern; and most of us in that part of the vessel got chairs, and seated ourselves near the chimney, where the luggage was fastened; and there we were obliged to keep very tight, for the vessel made so much motion, that we could not keep our seats at all: between nine and ten o'clock that was.

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2491. Had she made any water?—I did not observe at that time; I had not been down stairs. About nine or ten o'clock the sea beat so violently against the ship, that she appeared to be quite unmanageable, and about ten o'clock she stopped quite. The ship had been making little progress for want of steam; but about ten o'clock the vessel stopped altogether. We asked, some of us, the reason of that; and it was told us, by part of the crew, that the captain had missed the buoy, which was at the Spit, as they call it, at the Dutchman's Bank, and that he had stopped the vessel in order to look for it. But it appears that he did not so do, because it did not appear that he had found that buoy; in fact, I think he had not, and we proceeded. There was so much water on the deck, that I could not stand it, and I went down into the cabin, and was followed by many in the vessel.

2492. Did you go on in the same direction after you had stopped?—I cannot exactly say, because, as I was at the stern, I could not see the exact motion of the vessel. I went down to the cabin, and there for the first time I observed that there was water in the cabin. We thought that there must be danger, and that it could not be there without a cause; we sent to the captain to come and see it, and he said he could not leave his ship; and the steward of the ship said it was only bilge water. There were six to eight inches in depth of water at the end of the cabin, so much so that those ladies and gentlemen who were sitting at that end of the cabin were obliged to leave the place altogether. It increased, and very soon spread over the whole surface of the cabin floor, not so deep in some parts as in others, but the whole of the floor was covered with water. We insisted upon the captain coming down to explain the cause of this, but instead of this an engineer came down, and said that a small screw of the boiler had escaped, and that the boiler was leaking, and the water had found its way into the cabin. We were conversing, different gentlemen in the cabin, as to the danger of this; it perhaps took up the space of ten minutes or a quarter of an hour in speaking of this danger of the water in the cabin; and after that time, finding we could not get any further information, we were silent upon it, and we saw it must be left to chance, and the vessel seemingly went on. I think half an hour elapsed before the vessel struck, that must have been half-past 11 o'clock; an hour must have elapsed from the time I went down into the cabin till the vessel struck entirely. We all ran up stairs; I did, and many others followed me, and we were all anxious to get on deck. When I got on deck the greatest confusion prevailed; the women of course began giving vent to their feelings; there were several of us that endeavoured to calm their feelings, by telling them that the danger might not be imminent, and requesting that they would be silent. We prevailed upon them, and the captain gave orders to the helmsman to steer the vessel first to port, and then to starboard, in different ways, and he kept varying his orders every moment. He also gave orders to the passengers to go to different parts of the vessel, on purpose to right her, to keep her buoyant, and we all, who were capable of so doing, followed his instructions. I myself kept running backwards and forwards in the vessel several times. We worked at the pump, and what we were told to do we did; and the consequence was, that for a full minute or two she floated on the sands, but not more; then she struck again, and the concussion was very great; it was very horrible to me particularly at the time. Then it was very evident that the danger was imminent, and there could be very little hope that the vessel could be saved. We immediately commenced playing on the ship. The chimney fell, bringing with it the main mast; it fell at the side of the ship. The scene of confusion that then commenced, as may be supposed, was very awful indeed, and the voice of the captain was very soon lost about that time. I heard no more of him, and I think myself that he must either have thrown himself overboard, or been washed over very soon. Many thought that he must have thrown himself overboard, and I think that must have been the case, because he was standing where there was so much rigging, by which he might have saved himself; but he was washed over, for I lost his voice. That was about 12 o'clock, and the sea was very heavy, and every wave that came against the ship broke over her entirely, or washed away some of the crew; and at about half-past 12 she was a complete wreck, not a piece left, except those pieces of wreck of the hull which were of course buried in the sand, and the vessel was completely broken; in a quarter of an hour she was completely broken to pieces. It completely formed a triangle in 10 minutes, and in a very few minutes it was broken through quite in the middle; and when she struck, till the final time of the catastrophe, it was not more than half an hour.

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2493. From the first time that she struck, or the second?—From the first; because from the first to the second there was a very little interval. These are the main parts of the narrative; but as I am not a nautical man, I did not make any observations upon the state of the vessel. I observed a tremulous motion on the ship; I thought it might arise from the motion of the sea, but the other passengers thought it arose from the bad state of the vessel. I was washed over into the water myself, and by a great providence it was that I had attached a piece of rope to my arm which was attached to the mast, and when I rose from the water I pulled myself to the wreck, and perhaps I was half an hour before I clung to the mast. It was part of the stern of the deck, to which the rudder wheel is attached. With very great difficulty I got upon that, in fact, with the assistance of one or two already upon it. Immediately I was upon it, a piece was broken from the hull of the vessel, and it floated, forming a raft, on which nine of us were saved altogether. That was about two o'clock in the morning; we drifted out a little to sea, and we floated upon it, and we were picked up at seven in the morning by a boat from Beaumaris. The rudder wheel was our support; we held to it, and it saved us, or we should not have been able to have remained upon it.

2494. Were you all males?—No, there was one female who was saved, Miss Whittaker, she was upon it. We got to Beaumaris about 11 o'clock, and received every attention there; and I set off in three or four days from that part of Wales.

2495. At Ormes Point the vessel scarcely made any way at all?—No.

2496. Did she continue at that or did she increase her speed?—I have not made any inquiry as to the distance, but the sun was setting at that time, and from that time to 12; we were four hours making that distance.

2497. What time is the voyage generally made in?—From six to seven hours.

2498. Then you were in fact from a quarter to 11 to 12 o'clock?—Yes.

2499. Was there any light on board?—There was a light on the binnacle. I thought the ship had been set fire to, in fact I am confident it was; the light set fire to the wood, and was put out again by the great violence of the sea breaking over it.

2500. Was that before she struck?—No, it was after she struck. There was also a light at the binnacle; and when there was so much confusion on board, "Where is a gun?" and "Where is a light?" "Why do not you put up the lights?" which were not attended to, I cannot say why, I was standing at the stern, and a sailor came and took the light from the binnacle, threw it on the deck, and extinguished the light and broke the lantern. He was an old man, and whether he was saved or not I do not know, but my impression is that he did it on purpose.

2501. Were there no lights hoisted?—No.

2502. No gun fired?—No gun fired.

2503. Was there a gun on board?—I did not know; Mr. Watson, who was examined, said that there was a gun in the ship at the time.

2504. Did they sound when they went on afterwards, after looking for the buoy?—No.

2505. Was the state of the captain a partial or complete inebriation?—My opinion differs from that of others upon the subject. I cannot say whether he was completely intoxicated; he might have been drinking, and he remained in the cabin at dinner for a considerable time, but I saw him afterwards, and he seemed to give his orders very collectedly, and gave his orders to the last moment, for I followed them and obeyed them myself.

2506. Did he show a calm temper of mind when he saw his situation?—He was not a calm man, he was a boisterous man, noisy all the day long.

2507. How do you reconcile his being calm with his orders being contradictory every moment?—His orders might have been correct for what I know, he might have been directing the vessel correctly.

2508. You think that did not arise from the confusion of his mind, because you stated that he varied his orders continually?—I think he was calm, and knew what he was about.

2509. Then he was not more calm in the first instance?—No, I think not; my opinion always varied with most of the other survivors upon that point.

2510. To what do you attribute chiefly this misfortune?—I cannot say; I think the captain was very culpable; I think the captain knew the danger very well, but he seemed to be an impetuous man, and would rather go on than turn back, and lose a little reputation, perhaps.

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2511. If he had turned back, would the danger have been avoided?—I think it would; he might have run back or dropped an anchor, it seemed easy to do.

2512. Then the accident arose from the obstinacy of the captain, in insisting on going on?—Yes; the danger of going back might appear to him as great as going forward, but that he knew the danger, I certainly think he did, because a full hour before the ship struck he came down and met the steward, and made a motion, throwing up his head and his hands, in fact, a motion that all was lost; and that was sometime before the vessel struck. The steward turned pale; he went to the table again, where he was making his accounts, and I went round to him and whispered in his ears, and said, “I shall be obliged if you will let me know whether there is any danger, I will not make it public, but will make use of it;” but he said, “No, No;” but that was after the captain had made that motion with his hands, that all was lost.

2513. Would not the same danger have happened to any vessel under the circumstances, when she got so far on the sand-bank?—Yes, I think so; any vessel on the bank must have been in great danger.

2514. Then the accident arose not from the badness of the ship, but from the running on the bank?—That is a point to which I am not competent to speak.

2515. Did you not observe that they were obliged to trim the vessel with the chain cable?—Yes, all the day long.

2516. Had you a head sea all day?—It was nearly head; it was beating against the side considerably.

2517. Did not the pilot leave them?—I am not aware that there was any pilot on board. There was a pilot; but that pilot did not form part of the complement on board. If we had known that there was a pilot on board, the conduct of the captain was so extraordinary that we should have taken the command from him; but there was a Liverpool pilot on board merely as a passenger; he had been travelling the two or three preceding days, and he was very much fatigued, and we did not know anything of him. I did not know that there was a pilot on board till I saw his evidence at the coroner’s inquest. If we had known that there was a pilot on board, I think we were so dissatisfied that we should have taken measures against the captain.

2518. Do you know whether the captain knew that he was a pilot?—No, I do not.

2519. Can you tell the Committee whether you saw any timber afloat that was thrown on shore after the vessel was broken up?—I saw a great deal of it, but I did not particularly examine it at the time that the timbers were on shore. I was very much bruised, and I did not look at it; but I heard the timbers washed ashore. In fact, there is a large piece of timber, which is in the possession of the Rev. Mr. Vincent, which he stated to be perfectly rotten. In fact, I think the vessel must have been bad; because, in the first place, the vessel going to pieces so very soon, to any person not acquainted with that sort of thing, the sea could not have broken it up in so incredibly short a time. The timber was broken into a hundred or a thousand pieces, completely broken to pieces in that short time, so much so that when we were upon the raft we experienced a great deal more danger from the timber striking against us than from the sea.

2520. There were nine people saved upon this piece of wreck; was that the whole number that had attained it; did more get to the wreck?—No more got to it.

2521. How did you secure it?—We held by the rudder wheel, which was fastened to it; we had nothing but our hands.

2522. When the sea struck you did you find it difficult to hold?—Yes, very difficult; our bodies were a foot or a foot and a half in water, and it broke right over us completely, but not one of us left our holds.

2523. Did you give any assistance to the female?—On the contrary, she assisted us; she was a strong woman; I owe a great deal to her; she gave me a great deal of assistance now and then; certainly a woman possessing a great deal of presence of mind indeed; bodily strength was required considerably.

2524. What might have been her age?—About 35, I think.

2525. Was there not a general remark which you witnessed, and did not you yourself make a remark with regard to the straining of this vessel to a great extent at a very early period?—At a very early period in the day-time, considerably; but I think I observed before, that I attributed this to the heavy motion of the sea against her. There was an extraordinary motion in the vessel, and different persons attributed

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buted it to different reasons. I had been in many steam vessels, and I never felt such a motion before; but I had never been out in a gale of wind, and I attributed it to the violence of the sea then.

2526. Do you attribute it to that cause now?—My opinion is changed now, from what has happened since; it might have been from the unsoundness of the ship; I do not say that I could speak positively.

2527. You say that you were sitting upon the funnel; did the sea break fairly over the ship, so as to drive you at last from that part of the vessel?—No; it was only the spray that came on the ship.

2528. Did it break considerably, to leave a certain quantity of water behind?—Yes; in fact there was not one person upon deck that was not thoroughly wet through.

2529. Might not the hold have been filled with that water through the spray?—It might; only the engineer stated the screw had got loose in the boiler, and that led me to think that it arose from that cause.

2530. Was that engineer drowned?—I do not know.

2531. Was the water in the cabin hot or cold?—It was warm, but that was explained by some persons from the violence of the water beating against the ship: it appeared to be warm.

2532. How many sailors were there in the vessel?—I think there were only two on deck.

2533. Was there apparently any difference of conduct in the captain before dinner and after, as far as you could judge?—There seemed to be some difference, but I had made no observations on his conduct. I thought he was a very impetuous man; he was very unpolite and very uncivil in his replies to the passengers.

2534. You were not before the coroner?—I was not.

2535. Was there anything particular in Mr. Watson's conduct subsequent to the wreck?—His conduct certainly was very indecorous indeed, very much so. He was expostulated with by all, and the more he was expostulated with the more he seemed to glory in his misfortune. It might have been from the reproofs he met with from all parties. In fact he seemed to be devoid of feeling. I saw a good deal of him in the coffee-room.

2536. How long had the captain been in the vessel?—From two to three years.

2537. He must have known, then, the state of the vessel?—He must have known it very well indeed.

2538. Did the little way the vessel made arise, in your estimation, from the defective state of the machinery, or from the heavy sea?—I attributed it to the heaviness of the sea.

2539. Was the steam up all the time?—It appeared to be up the whole of the time.

2540. How was the vessel provided with the means of making signals, in case of distress?—It did not seem to have a signal.

2541. Was there a bell?—There was a bell, which was rung; it was not rung before the vessel was on shore.

2542. If it had been rung, could anybody in that gale of wind have heard it from the shore?—No, not at all.

2543. How far is the Dutchman's Bank from Beaumaris?—Four or five miles. The fact is, as regards myself, that after she was once on shore, I did not see that there was the least hope, even if there had been 20 guns on board. I consider that the number that was saved, 21, was very great; for the vessel was so completely fixed on the sand, the sea was so heavy, and the ship broken so much by the waves, that I did not conceive there could be a real hope for a soul.

2544. Did that boat that came out from Beaumaris and picked you up, come out by accident?—No; we were seen in the morning about 10 o'clock by a gentleman who was using his telescope, which he was used to do, and he thought he could see a piece of wreck with seven persons upon it; there were nine, and immediately he gave the alarm, and a boat was sent off, which took three of us first.

2545. How many boats had the *Rothsay*?—She had only one at the side of the vessel; that must have been swamped in the early part of the occurrence: that boat I should not have thought of getting into myself, because it appeared to be so small that it could not save a person in that heavy sea; in a calm sea it might have been of use. In fact there was at one time a woman that got into the boat with a child; she appeared to be much agitated; there were many that saw she would

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be lost if she continued in the boat, and they dragged her by force out of the boat with the greatest difficulty, and I did not see that any person got into it afterwards. I lost it very soon, because that part of the vessel was soon broken.

2546. How many persons were there on board?—Between 120 and 130; the names of the lost have been ascertained to be 110; there were 21 saved; that would make 131.

2547. Did it appear to you that there were too many passengers on board for the state of the weather?—No; in fact I was surprised that there were so few on board; but I accounted for it by the weather being dull, and most of the females in the other part had gone down stairs; on the deck there was room for a great many more.

2548. Do you know what the size of the engine was?—I have heard it, but I do not recollect at this moment.

2549. Did not the men on board go and lift a part of the machinery?—They did.

2550. In lifting that part of the machinery are you aware whether any person brought off any part of the timber?—No; in fact Mr. Watson and his agents were anxious to preserve whatever they could for themselves. There was every now and then a piece washed on the opposite shore, on the coast of Caernarvonshire, which different gentlemen picked up and preserved, but the larger pieces were taken by Mr. Watson and his agents.

2551. Who is Mr. Watson?—He is a young man, and he is owner of this vessel, and has a share in another.

2552. Did you speak of this young gentleman, or the father, when you said that his conduct was indecorous?—The younger, the owner of this vessel.

2553. Was he on board at the time of the wreck?—He was not on board.

2554. It was quite across the middle she broke, just at the boilers, was it not?—Yes.

2555. You had no means of judging whether the captain's sense of danger appeared to arise from the state of the vessel or not?—No, none at all; I have been led to think that was the case, from conversations I had, but I could not discover from my own observation.

2556. From that collectedness which you evinced during the whole occurrence, is there anything which you can suggest which, supposing you could have anticipated so melancholy a catastrophe, in the way of signals, or in any way whatever, could have prevented its occurrence from either a bad sea, or the ignorance of the captain?—Yes, I certainly think there is one thing particularly. We were certainly not more than half a mile from the land, and although a bell could not have been heard on the shore, or our collective voices be heard, a swivel or a gun might have been heard. There was a man at the time upon the land, at a place called Puffin's Island, and from that point we were certainly not more than half a mile, and not so much as that, I should think, and with a gun, I think, we might have been heard; but that was the only signal that we could make.

2557. Was not the state of the sea such, that no boat could have come out to you if the signal had been heard?—I do not know as to that, because I am not a nautical man; but there are life-boats to come off in such danger.

2558. Do you think you could have managed to fire a gun? Would not the sea constantly coming over you have prevented you? Would not the powder be likely to have been wet?—There would have been great difficulty; it is probable that all the powder would have been wet; but in such circumstances as these every thing is but a chance.

2559. Do you happen to know whether there was a life-boat on shore at the time?—Yes, I do know that; it was mentioned on board that there was. There were several gentlemen in the vessel who said, "If we could but make this man hear, there is a life-boat on the spot."

2560. Could anything, in your opinion, have prevented the catastrophe from happening, supposing the vessel had been sound?—I am not competent to answer that question.

2561. Was the vessel insured?—She was insured 1,500 £, partly insured. Mr. Watson stated to me that she cost him 4,000 £.

2562. How long before?—Very shortly, because he had bought her at first, and had caused a great many repairs to be made upon her. In fact, I believe the repairs have not been paid for yet, they were done so short a time ago.

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2563. Was the person who effected those repairs examined before the coroner?—No, he was not; but there have been certificates that have been signed at different times by those parties.

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2564. Was not your own health affected by this catastrophe?—A little, but I was very poorly at the time.

Mr. Thomas Henry Maudsley, called in; and Examined.

2565. YOU are in the habit of making steam engines?—Yes.

2566. For all purposes?—Yes.

*Mr.
T. H. Maudsley.*

2567. Are there any engines made for purposes for which it is necessary to regulate the speed of the engine?—Yes, most of them require regulating, at least are regulated by the governor of land engines.

2568. For what purpose is steam required to go faster at one time than at another?—We do not make any to go faster at one time than at another.

2569. Do you make engines for any purposes for which it is necessary that the engine should perform 20 revolutions at one time, and 16 at another?—No; they are all subject to that.

2570. Do you make steam engines on purpose to go at different times at different speeds?—No, I am not aware of any.

2571. Do you think an engine could be made, with an index or machinery attached to it, which should regulate its revolutions perfectly?—I should think in all engines you could vary the speed from full speed to any speed you wish.

2572. How would you do that?—By the throttle valve, an injection, and different parts there are about it.

2573. If you connected an index with the throttle valve and the injection, you could with certainty set your engine to go at 15 or 20 revolutions?—No, I do not say that; I do not think there can be any fixed index to regulate that, because engines, if they are not kept in a good state, vary, because a throttle valve will require more opening at one time than another.

2574. But you could always produce a certain number of revolutions?—Yes.

2575. If it were going at full speed, you could make it going one half or one quarter?—You could; it is in the management of the engineer to do it.

2576. Could a permanent index be formed on an engine, which shall be marked with a number of revolutions, which shall indicate the speed?—No.

2577. You are of opinion that, in order to regulate the speed of the vessel, the engineer must use his judgment upon every separate occasion?—Yes, I consider so.

2578. Supposing that you have a vessel that makes, when her engine is in good order and repair, 24 revolutions, if you wish to reduce that to 12 revolutions, will it not always be in the power of your engineer, by the means of his throttle valve, so to reduce it?—I should consider it so quite.

2579. Would it be in his power to reduce it to 16?—Yes.

2580. And the thing is so far perfect that he will be able to count it, to see that he has arrived at that point?—I should consider it so.

2581. And if he puts his index to the usual place to which he puts his index for 16 revolutions, and then he finds she is going 18, from any particular point about the engine at the moment, would it not be in his power to turn off the throttle valve still more to 16?—Certainly; but I do not consider that if there were an index, with a mark if it went 16 revolutions in a minute, in a week's time, if you put it to that, it would go that exactly.

2582. Supposing, from the engine being more used, or other circumstances, it did not produce the same result, would it not be easy for the engineer to produce that result by the means the throttle valve gives him?—Certainly.

2583. In short it amounts to what you have said already, that the engineer must use his judgment in every case?—Yes.

2584. It would be in the power of the engineer to reduce his speed?—Certainly.

2585. By what means could he do that?—By the different parts belonging to the engine which he is acquainted with.

2586. Did you not say the throttle valve?—That is one part.

2587. Is not that the main agent?—Yes.

2588. What is the shortest period in which you could stop the speed of a vessel at full way?—A good deal would depend upon circumstances in that case.

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2589. How soon could you stop the engine?—After the word is given, an engine will go on some little part of a revolution in spite of all the momentum that the vessel has, but perhaps it may be stopped not to take half a ton or three quarters of a ton.

2590. In your opinion what way would a vessel make after that?—That would depend a great deal upon circumstances, and upon what rate she was going at the time, and upon the tide and the wind.

2591. Supposing you have an engine in a vessel that goes 24 revolutions, and you have an index and reduce it to 18 revolutions; suppose you take that vessel a month afterwards, and keep the vessel as near as you can in the same trim, you say that by putting the engine to 18 you will not get exactly 18?—No.

2592. Will you not keep close to 18?—You will not be far from it; but if the engine was in a better state in a month's time than when the experiment was made, it would go more.

2593. Would it vary much?—I consider not.

2594. Do you answer this experimentally, from having tried the experiment many times, and under different circumstances?—I have not made any particular experiment; I have frequently seen a vessel put back, and so on.

2595. Have you made experiments as to the number of revolutions that produce certain speeds?—No, I have not.

2596. Suppose that there was an index or tell-tale placed upon the engine to show the number of revolutions, are you of opinion that the speed of a steam vessel can be regulated under all circumstances by the number of revolutions of the shaft, as shown by such an index?—I should consider so, if I understand the question right; what 16 revolutions did one day they would not do in another.

2597. Supposing there was a strong head wind and a swell, would not there be extreme difficulty in getting a vessel to make the same number of revolutions as if she were going at her greatest speed in smooth water in a river; supposing she went 24 revolutions in smooth water, would she be likely, in a head sea and a gale of wind, to make as many as 24?—No, certainly not.

2598. If a vessel has the power of making 24 revolutions when in good trim, does she not almost always make 16 revolutions, and would not those 16 produce almost always the same effect, although it would require a greater quantity of steam?—Not under those circumstances, against a head wind and so on.

2599. In a vessel, with engines in a proper proportion to her size, and a vessel properly trimmed, how long would it be from the period of starting after she had stopped till she was at full speed?—I hardly know in how short a time it might be done; but I should consider in a very short time indeed.

2600. How soon would it be from the period of starting to full speed, provided the engines were in a proper trim?—It would take some time to get the vessel in speed again, but I do not know how long; it must depend upon circumstances; it depends very much upon the form of the vessel, and wind and tide, and all that forming against her.

2601. With a vessel in proper order and properly trimmed, how long would it be?—A very short time; three or four minutes; but so much depends upon the form of the vessel.

2602. Provided her speed was merely checked one half, how long would she be before she got to full speed again?—A very short time indeed.

2603. What difference would there be?—Less than half the time, I should consider, considerably.

2604. Have you been much on board the steam vessels, so as to witness those results?—Yes, I have. I do not make a practice of going on board of them, but I have been very frequently.

2605. Are you not generally employed in the manufacture of steam vessels?—Yes, that is the state of the case certainly.

2606. So that the effect upon the different build of a vessel is not very minutely known to you?—No; I know that there is very great difference in them, certainly; I am aware of that.

2607. You have stated in your evidence that you stop the speed of a vessel with great facility by a throttle valve and other means; are not the other means merely consequent upon the effect produced by the throttle valve, or are they aids upon the effect produced by the throttle valve?—No; there are injection cocks for admitting the

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the water into the condensing steam; if that is not regulated properly with the throttle valve it will do mischief.

2608. It will have the effect of stopping the vessel?—Yes.

2609. It is necessary to proportion the quantity of water in the injection pipe with the quantity of water in the throttle valve?—Yes.

2610. It is not the injury to the machinery you are speaking of?—No, not at all; it would not affect the machinery.

2611. If you did turn off the steam by the throttle valve it would stop the vessel?—Yes.

2612. What is the greatest size of the shaft of an engine that you have known?—That depends upon the size of the engine and the diameter of the wheels, and all those sort of points.

2613. You have a regular scale according to the depth of the shaft, have you not?—No; some are 33 and 34 in a minute, and the lowest 18 I should think.

2614. The three feet one makes 28, does it not; and four feet 24, does it not?—I do not know exactly.

2615. The Lightning has a four feet piston?—Yes.

2616. And that makes 24?—Yes.

2617. And the three feet pistons make 28?—Rather more than that, 30 or 32.

2618. And the one you are making will go 20?—From 18 to 20.

2619. If you had an index upon an engine, and the shaft performed 32 revolutions in a minute, when you regulated that so as to get 16, say, which is the half of the number of revolutions, it would not show the same speed, all other circumstances taken into consideration, as 16 would do if there were only 22 revolutions at the utmost?—Of course not.

2620. Have you any idea of what the general width of horse power of an engine is?—We reckon the steam engines on board a steam vessel a ton per horse, except in large engines it is rather less than that; that is, with the boilers and water, and the 12 hours coals included.

2621. Not at all regulated by the tonnage?—No.

2622. There is no regular table of calculation of the expense according to the power of engine?—No, there is no regular table, because one person's terms are different from another.

[A Letter from Mr. David Napier to John Richardson, Esq. was delivered in and read.]

See Appx. No. 4.

Charles Denham Orlando Jephson, Esq., a Member of the Committee, Examined.

2623. WERE you on board the Pluto and Lightning steam vessels?—Yes.

C. D. O. Jephson,
Esq. M. P.

2624. Will you state the result of your observations?—I was in the Pluto steam vessel on Monday last, and the Lightning yesterday; several Members of the Committee were also present on both occasions. Our observations were chiefly directed to the efficacy of the throttle-valve, in regulating the speed of the vessel, and to the effect of the vessels on the surface of the river. The handle of the throttle-valve rod, in the Pluto, moved over an index correctly divided into four parts, each of which was subdivided into quarters. The Lightning had no graduated index, by which the opening of the throttle-valve could be accurately ascertained. From this cause there may be some inaccuracy in the results. Our only guide was a portion of a circle of six inches radius, pierced with nine holes, at equal distances; to the throttle-valve rod was attached a small arm, of about six inches in length, the end of which was pierced with a hole, to correspond with the holes of the index, so that an iron pin, placed through both, would fix the valve to any position required. I have referred to the holes of the circle thus, calling the first hole, at which the valve is closed, No. 1; and the lowest, where it is quite open, No. 9. The intermediate space, therefore, is divided into eight parts, of about $\frac{1}{8}$ of an inch.

C. D. O. Jephson,
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See also Appendix,
No. 9.

LIGHTNING STEAM VESSEL.

THROTTLE VALVE.	Revolutions of Paddle Wheel.	Knots per Hour.	
Open - - - - -	23. 23.	7. 3.	
$\frac{1}{2}$ closed - - - - -	22.		
$\frac{3}{4}$ closed - - - - -	19 $\frac{1}{2}$. 20.	6. 7.	
The centre of the short arm, being placed about 1-8th of an inch beyond the first hole of the index, or at $1\frac{1}{8}$	13. 11. 10 $\frac{1}{2}$. 10 $\frac{1}{2}$.	4. 3. 7. 3.	
Under $1\frac{1}{8}$ - - - - -	11. 11.	4. 4. 4. 2.	
	15. 14 $\frac{1}{2}$. 13 $\frac{1}{2}$.	6. 2. 5. 2.	
$1\frac{1}{4}$ - - - - -	11. 12.	4. 4. 3.	
	12 $\frac{1}{2}$. 12.	4.	
$1\frac{3}{4}$ - - - - -	17 $\frac{1}{2}$.	6.	
Full speed - - - - -	17 $\frac{1}{2}$.	6.	
	14. 14 $\frac{1}{2}$. 15. 15 $\frac{1}{2}$. 15 $\frac{1}{2}$.	5. 4. 5. 4.	
2 - - - - -	16. 16 $\frac{1}{2}$. 18 $\frac{1}{2}$. 19. 13. 13.	6. 5.	
	21 $\frac{1}{2}$. 21 $\frac{1}{2}$. 22 $\frac{1}{2}$. 23.	7. 3. 7. 2.	
No. 3 - - - - -	23.	7. 2. 8. 2.	
	22. 22. 19 $\frac{1}{2}$. 19.	7. 5. 7. 3. 6. 5.	

The experiments linked together were made while in the same course.
The supply of steam was kept up well throughout.

This observation was made
in a strong eddy, and imme-
diately after a sharp turn from
one reach of the river to an-
other.

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PLUTO.

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	Numbers marked on the Index.	Revolutions.	Knots, common Log.	
When lever fixed at (or full steam)	4.	$\left. \begin{array}{l} 26. \\ 25\frac{1}{2}. \\ 25\frac{1}{2}. \\ 26. \end{array} \right\}$	$\left. \begin{array}{l} 7. \\ 7. \\ 7. \\ 7. \end{array} \right\}$	With wind. 4. 6. Against wind.
$\frac{3}{4}$ speed	3.	$\left. \begin{array}{l} 25. \\ 24. \\ 25. \\ 25. \end{array} \right\}$	$\left. \begin{array}{l} 7. \\ 7. \\ 7. \\ 7. \end{array} \right\}$	With wind. 6. Against wind.
$\frac{1}{2}$ speed	2.	$\left. \begin{array}{l} 24\frac{1}{2}. \\ 26. \end{array} \right\}$	$\left. \begin{array}{l} 7. \\ 7. \end{array} \right\}$	2. 9/10. With wind.
	1.	23.	7.	With wind.
	1.	23.	7.	2. With wind.
	1.	22.	7.	Against wind.
$\frac{1}{4}$ speed	$\frac{1}{2}$.	$\left. \begin{array}{l} 20. \\ 18\frac{1}{2}. \end{array} \right\}$	$\left. \begin{array}{l} 6. \\ 6. \\ 6. \\ 5. \end{array} \right\}$	1. Massey's log.

The result of these observations shows, that the throttle-valve is useless in regulating speed when closed to one half its area, or to what is usually called half-speed; that at three-fourths closed, the diminution of the number of revolutions is very small.

That when within a short space of time, and under similar circumstances of wind, &c. the revolutions of the paddle-wheels, at any given opening of the throttle-valve, are counted, if the valve be then altered, and, after a short time, it be brought back exactly to its former position, the effect on the piston is very regular, but that if the first and second experiments be made at any long interval, and under different circumstances, the same number of revolutions cannot be calculated on. At any time, however, the action of the engines could be reduced to within three or four strokes of the number required with very great rapidity.

From full speed the engine was stopped in the following periods:

1st trial in 15 seconds, shaft making $1\frac{1}{2}$ revolutions after the shutting off
the steam.

2d — 5 — — — — — $\frac{1}{2}$ —
3d — 18 — — — — — 2 —

The engine was stopped, and the action of the wheels reversed in 32 seconds.

The waves created by such vessels appear to be of two kinds, arising from different causes.

Two lines of large rolling waves or swells commence from under the paddle-wheels, they remain, without extending themselves materially, in the track of the vessel, separated by a smooth space. At five or six knots speed, they appear to unite at about 150 to 200 yards from the vessel, and terminate in one large wave, which foams up like a breaker.

Two other waves arise from the resistance of the water to the power of the engine, which forces on the vessel with a *series of impulses*. These waves are thrown off by the bows, though (according to the build of the vessel) they may seem to come from the paddle-box. When at full speed they appear to form an angle of 35 or 40 degrees with the keel; they extend at this angle, until they gradually subside, or until they shall have been intercepted by the shore.

Should any boat or vessel pass the steam-boat, it is affected by this line of wave whenever it crosses the angle so formed. A boat passing at about 30 yards from the steam vessel, and keeping a course parallel to it, appeared to be affected at about 100 yards in the rear. In slow motion, this wave is scarcely perceptible.

C. D. O. Jephson,
Esq. M. P.

7 October 1831.

In sailing vessels, this wave is not so apparent, as the power is even and continuous, while that of the engine acts by a series of strokes or impulses.

The curl or paddle waves are frightful at first starting ; at full speed they nearly cease, but the water passing from under the paddle appears much agitated and white with foam ; at every increase of speed, the paddle wave becomes very great, and dangerous to boats which may be in the wake of the vessel ; it gradually subsides down to the amount of wave which seems to attend particular rates of speed.

The paddle wave appeared to me greatest at the speed of from $4\frac{1}{2}$ to 6 knots per hour. Above and below these rates it decreased; the variation of the number of strokes would be a more accurate measure than that of distance, to show the increase or decrease of paddle wave; with deeply immersed wheels, forcing on a heavily laden vessel, this wave must always be considerable.

For this reason I do not see any advantage in checking the speed of steam vessels (looking to their effect on the water only, without reference to the danger of running down other vessels, which can always be avoided with proper caution), as it appears to me that, in proportion as you diminish the stem or bow wave, by diminishing speed, you increase the equally dangerous one which comes from the paddle wheels. This wave is the more dangerous from the numerous turns of the river, and the number of changes in her course to avoid other vessels, which a steam-boat must make, and when two steam-boats are going in the same direction, near each other, but not in the same track, the four paddle waves would occupy nearly the entire width of river left between the tiers.

In making these observations, as to the effect of the vessel on the water, I am aware that many of those gentlemen who were present do not coincide with me ; and I must also beg to add, that the results I have stated were much more evident in the *Pluto* than in the *Lightning*.

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A P P E N D I X.

Appendix, No. 1.

LETTER from Captain *Basil Hall* to Colonel *Sibthorp*.

Appendix, No. 1.

Dear Sir,

Putney Heath, 17th September 1831.

I SEND herewith, for the information of the Select Committee on Steam Navigation, the pamphlet to which I alluded in my Evidence yesterday. At the place which I have marked, will be found a letter from Messrs. Carmichael of Dundee, describing the hand-gear devised by them for regulating the movements of steam vessels on deck. When first questioned yesterday as to the expediency and prospects of limiting the rate of steam vessels going in the Pool, I was rather averse to any restrictions as to their speed; but upon reconsidering the point at the suggestion of the Committee, I came to see that such limitation was reasonable enough, and I trust the notes taken of my testimony are explicit on that head; I merely recur to that branch of the topic just now from an analogy having occurred to me, which may possibly be useful to the Committee. It strikes me that we have as much right to interfere to limit the rate of steam vessels in the Pool, or in any other crowded part of the river, as we have to prevent furious riding or driving through the streets; if a man gallops along the Strand, the police will not only be authorized to check him, but the public will sympathise with and encourage such reasonable interference. I think I omitted to state to the Committee that one of the advantages of having the steering wheel forward in the bows, and under the personal or manual control of the pilot, is that a greater speed may then safely be allowed than when the helmsman is placed abaft far from the pilot, and when a considerable time must elapse before the wishes of the pilot are made to act on the rudder. If he have the spoke of the wheel in his own hand, he can thread his way with confidence and with safety to all parties, and at a much greater rate than would be allowable at present. Precisely on the same principle I conceive that if the management of the steam machinery be placed under the hand of the pilot, and thus be rendered as much subject to his will as the motion of the rudder, a considerably greater speed may become perfectly safe. For if the pilot, or master, or whoever it be that directs the whole, can stop or back the engine, or set the steam on or off, at the very moment of need, and without the intervention of the engineer, it is quite obvious that he may maintain a greater degree of speed up to the instant when it is necessary to stop, than if he had not in his own hands the entire commands of such prompt action. I do not mean to trifle with the subject when I say, that I conceive it would not be a much greater absurdity to place the driver of a carriage on the foot-board behind out of sight of his horses, and give him the reins in his hands, but subject to the orders of another man seated in front, than it now is to place the steersman of a steam vessel at one end of the vessel and the guide at the other. And what applies to regulating the direction of the impulse applies equally, or nearly so, to regulating the degree of that impulse; and I feel well assured that the Committee may do much good by recommending the adoption of these two plans, neither of them new or fanciful, but long tried and approved of in practice. I beg leave respectfully to suggest to the Committee, that Messrs. James and Charles Carmichael, engineers at Dundee, should be called upon to furnish to the Committee such working drawings of their apparatus as might be engraved, so as to form an appendix to the Report, accompanied of course by the necessary descriptions, and practical suggestions as to the best methods of prolonging the powers of this hand-gear to the same spot where the steering-wheel is placed. I omitted, I believe, to state another advantage, and a very considerable one, as it appears to me, of having the steersman forward. It will leave the quarter deck and poop entirely free for the passengers, and exempt them from the eternal worrying of the captain to "keep out of the way of the helmsman." I have heard ladies laughed at for asking, when they were shoved about in this rude way, "What business has the helmsman here amongst us?" The question was perfectly reasonable, however. I fear I did not dwell sufficiently on the great practical advantages of having the shank or axle of the paddle-wheel divided (as it is universally in the United States and Canada), so as to be thrown into gear or out of gear by a strong coupling-box, at pleasure. I have seen many occasions on which it was highly useful to let the engine go on, but to stop the paddles, and many in which it was necessary to stop the engine, but to allow the paddle-wheels to turn round.

I remain your obedient humble servant,

Basil Hall.

Appendix, No. 2.

Appendix, No. 2. PAPER delivered to the Committee by Mr. *Jacob Perkins*, on Paddle Wheels, and Explosion of Steam Boilers, September 27, 1831.

Paddle-wheels and Swell.

SHOULD the Committee require my opinion as to whether the swell on the Thames, occasioned by steamers, could be materially reduced without diminishing the speed of the boats, my answer would be, that from experiments which I have made, I have no doubt that the evil may be abated, and that the wave produced by a three-miles speed, with an apparatus now used on the Thames, is greater than a 10-miles speed would produce with such a wheel and boat as might be employed.

The difference in the extent of agitation produced on the surface of the water, whether going with or against the tide, is more than is generally imagined; for instance, if a boat be allowed one hour to come from Greenwich to St. Catherine's Docks (say the distance to be six miles), without reference to the tide, then, should the tide be flowing at the rate of four miles per hour, the boat would have to move short of two miles per hour through the water; but if the tide be against the boat, her speed through the water must be over 10 miles per hour; for when the boat is going with the stream, she is descending an inclined plane, but when going against the stream, she is ascending an inclined plane. Even the American boats move with a higher speed and less agitation of the water than the English, and for the following reasons: Their boats are flatter, and draw much less water; they have also a finer run; the paddle-wheels are much larger. The fastest boats have wheels of 28 feet diameter. The float-boards used in those wheels produce a greater number of waves but reduced in size, and are of course less dangerous to small craft. The greatest speed of the most improved American boats is 14 miles per hour, without the assistance of wind or tide. And those boats moving on the surface, instead of dividing the water, instead of throwing off the waves to the right and left, glide over and do not agitate, but rather tend to smooth down the small ruffle on the water which may have been first caused by the bow of the boat. And I am decidedly of opinion, that with a boat of appropriate construction, the quicker it is impelled beyond a given point of speed, the less will be the agitation of the water. But to the formation and application of the paddles are to be traced, in a great degree, the inconveniences of which the public complain, and to which the attention of the Committee is chiefly directed. The paddle now in use acts near the surface. The paddle I would recommend would act in deeper water, and so produce less agitation on the surface, whilst the resistance would be greater, and consequently the power of the engine more efficient. The present paddles strike the water and produce agitation as they enter it, and on entering make a considerable hollow. On the contrary, were they to glide into the water, as a scull, much agitation would be avoided. The difference between the action of the common paddle-wheel and the one which I would propose is very great. The action of the common paddle is not much unlike the duck-foot, which moves in a right line with its body, and in the water already set in motion. The new paddle is more like the tail of a pike, which by its diagonal motion shoots its body through the water with incredible swiftness. The pike's tail, like the new paddle, acts against the water, which has not been set in motion until the tail glides into it: the several float-boards of the old paddle-wheel move in water already set in motion by the first float-board which strikes the water; the effect is to pile up the water in front, and leave a hollow space at the back of the paddle, which becomes more and more apparent as the velocity of the wheel increases. Thus the water at the surface is made to roll on and form the waves which cause so much mischief.

For a full description of the paddle-wheel which I would recommend, I refer the Committee to the accompanying printed paper; and a model of such a wheel I have with me.

[The same was delivered in, and laid upon the Table.]

Explosion.

I take this opportunity to mention a few facts, with the hope that they may tend to public benefit, and the prevention of explosion in steam boilers. A vast number of contrivances have been resorted to to remove this great evil. When the safety-valve was invented, it was supposed that this desideratum was accomplished, as nothing theoretically appeared more certain. It was believed that all that then remained wanting was a boiler stronger than the power required to work the steam-engine, after which all would be safe, if the safety-valve should be kept in order. Time and practice have disappointed those sanguine hopes. That the safety-valve cannot be depended on as a security against explosions is but too true; in fact, strange as it may appear, the safety-valve often hastens the explosion. It has been ascertained, beyond all doubt, that explosions frequently follow immediately upon the opening of the safety-valve. The cause of this paradox would still have been among the secrets of nature had not a recent discovery pointed out its source; and I trust that I shall be excused availing myself of the coinciding testimony of the celebrated Mons. Arago on this part of the subject.

In his publication on the explosion of steam boilers, he thus expresses himself: "How does it happen that a boiler bursts at the very moment of the opening of the safety-valve?"

“valve? How does it happen that the accident is almost always preceded by an apparent diminution in the elasticity of the steam? These questions, involving seeming paradoxes, are suggested by the accidents recorded in this paper. Mr. Perkins has, I think, answered them satisfactorily; and I shall lay before the reader the *explanation* given by that engineer.”

I now proceed with the explanation therein adverted to.

In one of my experiments in generating steam, I discovered that the temperature of steam was by no means the true measure of its power, although reposing on water, and that steam may be changed instantaneously from low to high steam of the strength of gun-powder, without any addition of heat. It is well known that in proportion to the *density* of steam, so is its power; and it was believed that, as steam increased in temperature, it would also increase in density, if in contact with water. This belief was the source of an important error.

In pursuing my experiments, though explosions frequently took place, they gave me the opportunity of witnessing some facts never before developed to my knowledge. The first hint which I received was from the melting of the packing (which was of lead) of the throttle valve. It appeared by the indicator that the temperature of the steam at the moment did not exceed 400 degrees; but the lead, which does not fuse under 650°, ran from the throttle valve like water, and permitted the steam to escape. The late Dr. Wollaston, who witnessed this new fact, was exceedingly struck with it. He accounted for it by supposing that the throttling of the steam occasioned sufficient friction to increase its temperature, so as to melt the leaden packing. As this was a plausible theory I gave in to it. But shortly after that experiment I discovered that the steam pipe, leading from the generator to the steam engine, had ignited its non-conducting covering, which was of hempen cord, (to do which required at least 800° of heat), and I then became satisfied that friction was not the cause of the accumulation of heat, since during the last occurrence the steam was not throttled, and then I began to suspect that the steam, although in contact with water, had got *supercharged* with heat. I immediately instituted the following experiments.

A generator was partially filled with water, and heated to about 500 degrees, and was consequently exerting a force of about 50 atmospheres, or 750 lbs. to the square inch; but the pressure valve being loaded to about 60 atmospheres, or 900 lbs. to the square inch, it prevented the water from expanding into steam. The receiver, which was destitute both of water and steam, was heated to about 1,200 degrees. A small quantity of water was injected into the generator by the forcing pump, which forced out from under the pressure valve into the receiver a corresponding quantity of heated water, and this instantly flashed into steam, which, from its having ignited the hemp cord that covered the steam pipe, 10 feet from the generator, must have been at a temperature of at least 800 degrees, which would be equal to about 80 atmospheres, or 1,200 lbs. to the inch; but from want of water to give it its necessary density, the indicator showed a pressure of only five atmospheres, or 75 lbs. per inch. Whether the pressure of the steam which was rushing through the steam-pipe, was 5, or 100, or more atmospheres, the steam-pipe kept up at the high temperature before mentioned, which I attribute to the steam being supercharged with caloric.

The pump was now made to inject a much larger quantity of heated water, and the indicator showed a pressure of from 50 to 80 atmospheres. It soon expanded (the throttle valve being partly opened) to the former pressure of about five atmospheres. The water was then injected again and again, and the indicator was observed to oscillate at each stroke of the pump, from five to between 40 and 100 atmospheres, according to the quantity of water injected; clearly showing that whenever the quantity of water was reduced, there was a great redundancy of heat, with little elastic force, and that the elastic force was suddenly increased by the mere addition of water. It soon occurred to me, that to this might be traced the true cause of the tremendous explosions that suddenly take place in *low as well as high-pressure* boilers.

There are many instances where immediately before one of these terrific explosions had taken place, the engine laboured, showing evidently a decrease of power in the engine. To illustrate this theory of sudden explosions, let us suppose the feed-pipe or pump to be choked: in this case, the upper surface of the water would soon sink below some parts of the boiler, which ought to be constantly covered by it, thus causing them to become heated to a much higher temperature than the water. The steam now being in contact with the heated metal, readily takes up the heat, and becomes supercharged with it. Practical engineers have frequently witnessed the destruction of the packing of pistons by their becoming charred, although the steam issuing from the steam chamber was, in its lower strata, in contact with the water, the temperature of which did not exceed 230 degrees.

It was very evident that this steam was supercharged with heat, and was much above the temperature of the water upon which it was reposing, and in a suitable state to produce explosion, had the water been allowed to rise into and give the steam sufficient density, by any sudden *reduction of pressure* on the water in the lower part of the boiler, by drawing off a part of the steam faster than it was generated.

Since caloric will not descend in water, it cannot be taken up by water placed below it. The steam thus supercharged, will heat the upper surface of the boiler, in some cases red hot, and will ignite coals or any other combustible matter which may be in contact with it. This fact I can illustrate by numerous instances on record.

Appendix, No. 2.

If the water, which is kept below the supercharged steam by the pressure of it, could, by any circumstance, be made to take up the excess of caloric in the steam, as well as that from the upper part of the boiler, when heated above the temperature of the water in the boiler, whether the boiler be what is termed a high-pressure, or a low-pressure boiler, the steam therein will instantly become highly elastic, and an explosion cannot be prevented by any safety valve hitherto used.

It was stated in evidence at the coroner's inquest, taken in the Humber, in the case of an explosion on board of the Graham steam-boat that just before the explosion took place, 20 lbs. weight was taken off the safety valve. Now, if the steam in that boiler had been properly generated, the relief given to the safety valve could not have produced explosion; but if the water had got low in the boiler (as was probably the case), and the steam supercharged with heat, the most ready way to produce explosion was to open the safety valve, thereby allowing the water in the lower part of the boiler to rise suddenly and give density to the steam above it.

Several instances have occurred when there has been sufficient warning, by the rushing of the steam from a rent or fracture, for the bystanders to escape from injury before the explosion took place.

There has been at least one case where the boiler was raised from its bed into the air by the force of the steam issuing from the rent (upon the principle of the rocket), before the water had sufficiently expanded (by the removal of the steam caused by the rent or fracture) to take up the heat of the boiler and the supercharged steam, when an explosion took place after the boiler had been raised many feet in the atmosphere, and separated with a very great report, one part rising still higher, while the other dashed with great force on the ground.

The full persuasion of my mind is, that such explosions are remedial by discoveries, which for the moment I cannot publicly mention, but which have been confidentially disclosed to an honourable Member of this Committee.

It is, I believe, a fact, that more persons have been killed by low than by high-pressure boilers in this country; and such has decidedly been the case in America. High-pressure boilers have been substituted in Flintshire within the last 12 months, for those of low pressure, after a destructive explosion of the latter, by which 16 lives were lost.

Harpur-street, 27th September 1831.

Jacob Perkins.

Appendix, No. 3.

Appendix, No. 3.

RETURN of the CASUALTIES which have occurred, either from Accident to the Machinery or Vessel, or from their getting aground, or otherwise, to the POST-OFFICE STEAM PACKETS on the IRISH STATIONS, during the years 1830-31; stating the Time of Detention, and the Means taken to obviate the probability of such Accidents in future.

1830:		MILFORD.
21 April	-	<i>Sybil</i> .—Grounded in Milford Harbour, in a very low tide; mail delayed 45 minutes.
5 Sept.	-	<i>Sovereign</i> .—Received damage in hull from a heavy sea.
20 Nov.	-	<i>Sybil</i> .—Received damage in hull in a gale at sea.
27 -	-	<i>Sovereign</i> .—Boilers sprung a leak in the flues, when preparing for sea, in Dunmore Pier. Mail transferred to the packet next in turn. Agent reports the delay was of less consequence, the storm being so violent no vessel could have arrived in time to save the mail coach at Milford, even had she started as soon as the mail reached Dunmore. The leak was trifling, and the packet returned to Milford the following day.
1831:		
1 March	-	<i>Sovereign</i> .—Feed pump of engine gave way. Packet detained 40 minutes.
5 -	-	<i>Sybil</i> .—Shipped a heavy sea, which stove the bulwark and did some trifling damage to the hull.
13 -	-	<i>Vixen</i> .—Paddle case damaged by a sea.
15 -	-	<i>Sovereign</i> .—Supporter of outward end of paddle beam started by a sea.
11 June	-	<i>Vixen</i> .—Feed pipe damaged; engines stopped for 30 minutes to repair.
8 Sept.	-	<i>Sovereign</i> .—Returned into port at 10 A. M., the rudder being damaged by the sea. Mail despatched in another packet at 1 P. M.
1830:		PORT PATRICK.
3 March	-	<i>Arrow</i> .—Feed pipe damaged in harbour. Packet detained 2 hours and 40 minutes.
13 July	-	<i>Arrow</i> .—Bolt of the mud-hole door of the boiler gave way at sea; engines stopped for 40 minutes to repair the damage.

1830:

PORT PATRICK—*continued*.

- 19 Dec. - *Dasher*.—Wrecked at Port Patrick, through a shift of wind in a hard squall, accompanied with a very heavy sea, at the moment she was entering the harbour. One woman and one boy lost.
- 1831:
17 March - *Arrow*.—Part of the bulwark stove by a heavy sea.

1830:

HOLYHEAD.

- 12 June - *Cinderella*.—Piston rod broke. Packet detained 25 minutes, and proceeded with one engine.
- 23 Dec. - *Harlequin*.—Bulwark and boat stove in by a heavy sea.
- 1831: 28 July - *Dragon*.—Link of connecting rod of starboard engine broke. Packet detained 15 minutes, and proceeded with one engine.

1830:

LIVERPOOL.

- 11 Jan. - *Dolphin*.—"A. M. 8. 10. Wore round and eased engines in Wallasey Hole, and in turning, grounded on the North Bank. Sent the mail in ship's boat to the Jonathan Hulls, to proceed to Liverpool immediately, in order to save the first delivery. 8. 50 under weigh."
- 27 - - *Dolphin*.—"A. M. 5. 35. Thick, with snow, and very dark. Water being very low, touched the ground on the main, but had not less than nine feet, and lay water-borne: water very smooth. 5. 45. Jonathan Hulls (steam tender) alongside for mail and passengers. 6. Jonathan Hulls put off with mail and passengers. 7. 30. floated off and set on engines."
- 27 - - *Comet*.—"P. M. 6. 30. Grounded abreast of the Patch. No fall of water. 8. 15. floated and set on engines."
- 15 Feb. - *Thetis*.—"A. M. 5. 45. Shoaled water to three fathoms; supposed on the main. Starboard the helm, but the water shoaled to two fathoms, and we found the ship almost imperceptibly on the ground. Reversed engines, but vessel remained fast. Captain off in the boat to sound. 6. 15. a shore boat came alongside, but they had not seen any lights, nor did they know where they were. 6. 25. day breaking: sent the ship's boat off with the mail, and some passengers in the shore boat. 1 P. M. ship afloat; set on engines."
- 8 March - *Comet*.—Side rod of larboard engine damaged. The vessel, after a delay of 35 minutes, proceeded with one engine, and made a fair passage.
- 5 Sept - *Dolphin's Journal*.—"A. M. 5. 20. Put mail and passengers on board Jonathan Hulls. 5. 45. the Jonathan Hulls grounded in the Rock Gut, and the mail and passengers sent up in boats."
- 4 Oct. - *Comet*.—"P. M. 7. Stopped the engines, the vessel touching the ground, there not being water for her between the Patch and the North Bank. 7. 45. set on engines."
- 2 Nov. - *Thetis, Journal*.—"P. M. 6. 30. Ship's boat returned to the ship with the mail, and reporting the small steamer to be aground in the Rock Gut, with a number of passengers on board. 8. 5. small steamer came alongside."
- 18 Nov. - *Etna*.—"A. M. 7. 35. Took the ground on the edge of West Hoyle Bank. 8. 20. backed off and set on."
- 20 - - *Etna*.—Paddle box stove by a heavy sea.
- 2 Dec. - *Comet*.—"P. M. 6. 5. Received the mail per barge. At low water the vessel touched the ground, which prevented her swinging to the first of the flood; it was occasioned by her dragging her anchor when the Jonathan Hulls was alongside. 8. weighed and set on."
- 13 - - *Etna*.—"P. M. 6. 40. Grounded in the Rock Gut, owing to the darkness of the night; let go the anchor. 7. 20. weighed and set on."
- 20 - - *Etna*.—Paddle box damaged by a sea.
- 20 Dec. - *Thetis*.—"P. M. 6. 5. Got a tow rope to Jonathan Hulls' stern; then weighed Thetis's anchor, and Jonathan Hulls setting on her engines to cant Thetis's head out. While in the most critical situation, between wind and tide, the tow rope by some accident was allowed to slip from on board the Jonathan Hulls, and before anything could be effected by the Thetis's engines, or otherwise, from this part of the Channel being so narrow, and within an hour and three quarters of low, she took the ground, and notwithstanding every exertion was used, she remained fast from the rapid falling of the tide. Drew the fires and emptied the boilers to prevent straining. 10. hailed Jonathan Hulls to come alongside, who took Thetis in tow and towed her off. 10. 15. let go Thetis's anchor, filled the boilers and got the steam up. 11. anchor up and engines set on."
- 1831:
15 Jan. - *Thetis*.—Strap of larboard connecting rod gave way; replaced by a spare one. Packet detained 10 minutes.
- 18 - - *Comet's Journal*.—"P. M. 5. Anchored at the N. E. buoy. 11. 20. received the mail, passengers, &c. from the Jonathan Hulls, she being detained by getting aground, owing to the foggy weather. 11. 30. under weigh."

Appendix, No. 3.

1831 :

LIVERPOOL—*continued.*

- 17 Feb. - *Comet.*—Broke one of the connecting bolts of the outer beam end of the starboard engine; stopped the engines for 10 minutes to replace it.
- 10 March - *Dolphin.*—" P. M. 5. 10. The eddy tide set us on the ground, and obliged to run a rope to Jonathan Hulls, to heave her bow off; flood tide. 5. 25. afloat and set on engines."
- 16 April - *Thetis.*—" A. M. 7. 20. Foggy, could not see the marks, and being near low water, the ship touched on the flats. Dispatched the mail and some passengers in a shore boat to Liverpool. 8. 20. backed off."
- 18 - - *Dolphin.*—Screws of eccentric rod broke; damage repaired on the passage.
- 21 July - *Thetis.*—Damaged by coming in contact with City of Dublin, passage vessel, in thick weather; head of Thetis and cutwater carried away.
- 12 Aug. - *Comet.*—A leak discovered in one of the flues when on the point of starting. Mail dispatched by the packet next in turn, which put to sea as soon as there was water round the rock. The delay was about five hours.

TOTAL - - 39.

All these casualties, with the exception of the loss of the *Dasher*, are of that ordinary description that no special measures could obviate the probability of their recurrence. The precautions which have been found by the Postmaster-general the best calculated to prevent accident, are the enforcing constant attention on the part of the engineers, and the periodical lie bye of each packet in turn for a few days, that the machinery may be thoroughly overhauled and adjusted.

General Post-Office, }
26th September 1831. }

G. H. Freeling,
Assistant Secretary.

Appendix, No. 4.

PAPERS relating to the Loss of the *ROTHSAY CASTLE*.LETTER from Mr. *Thomas Williams* to Lord Viscount *Melbourne*.

Appendix, No. 4.

Sir,

Beaumaris, 29th August 1831.

I BEG to acknowledge the receipt of your letter of the 27th, in which you request that I will transmit for Lord Melbourne's information, as desired by your letter of the 23d instant, copy of the evidence produced before the jury. I have not received any letter from you of the 23d instant, nor was any letter directed to me, received here, I have now the honour to enclose, for Lord Melbourne's information, a copy of the evidence produced before the jury. The carpenters whom I have sent to examine the wreck, report that the timbers which they have seen, are in an unsound state, and much too weak for a vessel of the burthen of the *Rothsay Castle*.

I have the honour to be, Sir, your obedient servant,

(signed)

Thomas Williams,

The Hon. G. Lamb.

Coroner of the Borough of Beaumaris.

LETTER from Mr. *James Sparrow* to Lord Viscount *Melbourne*.

My Lord,

Custom-house, Holyhead, 3d September 1831.

I MUST apologize to your lordship for the liberty I take in addressing you on the following subject. I attended a public meeting at Beaumaris, on Tuesday last, when, in consequence of the melancholy loss of the *Rothsay Castle* steam vessel, a petition to Parliament was decided on, praying that such regulations may be adopted with respect to such vessels employed in the conveyance of passengers, as will ensure to the public that they shall be of a strength that will, in all human probability, prevent an occurrence of another accident similarly fatal to that which has lately happened in that neighbourhood, for to her utter unseaworthiness, combined with the inefficiency of the captain to the discharge of his important duty, in consequence of being intoxicated, is the accident to be attributed. Should it be deemed expedient to comply with the prayer of that petition, I most respectfully beg leave to suggest what appears to me to be the easiest mode of effecting the object in view, viz. applying the provisions of the Act 4 Geo. 4, c. 88, to all steam vessels employed in the conveyance of passengers, so as to ascertain that they are seaworthy; that they are built of timber of sufficient size, fastened in such a manner as to give a proper strength to the ship according to her tonnage; the size of the timbers, which can be decided on by the master builders in the King's yards, to increase with the tonnage. I will first explain the present mode of obtaining a "certificate of registry," then suggest how the foregoing measure may be carried into effect. When a builder has finished a ship, and she

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is ready for launching, he gives a document to the first purchaser, called a "Builders certificate," (see Document annexed, marked A.) This document sets forth the particulars required by 6 Geo. 4, c. 25, the said purchaser or other person authorized by him, takes it to the surveying officer of Customs, at the port where the ship is built, who in the presence of the master, or such person authorized on the part of the owner, measures her, and if he finds that she corresponds in every particular with the description set forth in the builder's certificate, fills up agreeable to the 16th section of the said Act, (the form marked B.) and gives it to that authorized person. The master and owner then proceed with those documents to the collector of the port, who administers the oath required by the 14th section of the said Act, or in lieu of it, receives a declaration agreeable to the 1 & 2 William 4, c. 4, and takes the bond of the master and owner required by the 21st section of the first mentioned Act, and immediately issues a certificate of registry, agreeable to the 2d section of that Act. Those certificates do not set forth in any way the strength of construction of the ship; I therefore, beg to suggest, that the builder shall in the first instance extend his certificate A, by inserting therein the scantling of the ship's keel, floor, futtock, top timbers, &c. with a description of her fastenings, which shall be reiterated by the surveying officer of Customs in certificate B, with the addition, if such ship is intended to be employed in the conveyance of passengers, that the scantling of her timbers, and the description of her fastenings, are of the size and strength required (by such an Act of Parliament) according to her tonnage. A special licence might then be issued with the certificate of registry, authorizing the conveyance of passengers. It would be but very little trouble to owners of steam vessels, now so employed, to obtain from the builders of such vessels certificates of the foregoing particulars, and none whatever in respect of those now in progress of being built. Should it not be deemed advisable to require the strength of steam ships to be set forth by the builders in the first instance, such ships might be specially surveyed by the proper officer of the Customs, on an application of the owner for a licence to carry passengers, taking to his assistance one or more person or persons skilled in the building of ships, at the expense of the owner of the ship applying for such licence, and on their certifying that the scantling of her timbers, and the description of her fastenings, were of the size and strength required (by such an Act of Parliament) according to her tonnage, then a special licence might be issued, authorizing the conveyance of passengers. The first appears to me to be the least objectionable mode, and the readiest for all parties, but should it be deemed expedient to require a knowledge of the strength of steam vessels now employed in the conveyance of passengers, a special survey of them must be had in the manner suggested by the second plan. In my humble opinion, the futtock and top timbers of most steam vessels now afloat or building, except those built or building in the King's yard, would on a survey be found to be much too slight, slighter than those used in the construction of sail ships of equal tonnage, and much more so than the altered mode of navigating them justifies.

I have the honour to be, my Lord,

Your Lordships most obedient, humble servant,

(signed)

James Sparrow, Surveyor.

LETTER from Mr. James Sparrow to Sir R. B. W. Bulkeley, Bart., M. P.

Dear Sir Richard,

At Barron Hill, 15th September 1831.

IN reply to your communication stating that Colonel Sibthorp, the Chairman of the Steam-boat Committee has requested you to furnish him with the particulars of the wreck of the "Rothsay Castle," as he is about to submit to the consideration of Parliament such regulations as the Committee may deem necessary for the government of steam passage-vessels, and thereby, if possible be the means of securing the public against another accident of the kind, in consequence of a want of seaworthiness in steam vessels so employed. On the subject of her wreck it would be needless for me to say one word, as you informed me that the particulars of that melancholy event have been fully stated by the coroner's jury who investigated into the cause of her loss, to the Secretary of State for the Home Department, but on the subject of guarding against a similar accident in future, I beg to supply you, for the consideration of the Committee, the annexed copy of a communication that I submitted to Lord Melbourne, on the 3d instant, suggesting to his Lordship what appears to be the readiest mode of placing steam passage-vessels under regulations, and which when duly considered will, I believe, be found to be as free from inconveniences that may be objected to on the part of the owners of steam vessels, as any that can be adopted; which suggestions I have more fully explained at the foot of this letter in the form of an "Abstract of an Act for regulating steam vessels carrying passengers." From the affidavit of William Jones and William Owen that you gave me to peruse, of the size of the Rothsay Castle's timbers, measured by them, they appear to me to be very much smaller than the timbers that a vessel of her size, 75 tons*, ought to be built with, and the fastenings described by them appear equally inadequate; but on this point the master builders of the King's yards are best qualified to give an opinion; also to fill up the blanks in the following abstract of the scantling of timber and description of fastenings that ought to be used in the construction of steam vessels of every variety of tonnage. With every disposition to afford all the assistance in this matter that is in my power,

I remain, dear Sir Richard, your faithful and obliged servant,

(signed)

James Sparrow.

Vide p. 158.

Ibid.

* The register tonnage of steam vessels is less than the true tonnage, as the space occupied by the engine and boilers is not included in their admeasurement.

Appendix, No. 4. ABSTRACT of a proposed Act for regulating Steam Passage Vessels carrying Passengers to any Port or Place in Great Britain, Ireland and the Isle of Man.

Enact, That 4 Geo. 4, c. 88, be general for the United Kingdom, instead of being confined to "vessels carrying passengers between Great Britain and Ireland."

Repeal, That part of the said Act which exempts from its provisions vessels above 200 tons, and limits the number of passengers to the tonnage of the vessel, as far as applies to steam vessels, leaving its application to sailing vessels as it now stands.

Repeal, The 29th sect. of 9 Geo. 4, c. 76, which provides "that every steam vessel which is of the register tonnage of 140 tons or upwards, shall be deemed to be a vessel of 200 tons at least."

Enact, That it shall not be lawful for the master, &c. of any steam vessel to employ such vessel in the conveyance of passengers to or from any port or place in Great Britain, Ireland, or the Isle of Man, unless licence for the conveyance of passengers shall have been previously granted to the owner or master of such vessel, under the hand of the collector, or other chief officer of customs, at the port to which such vessel shall belong; and that it shall not be lawful for such collector, or other chief officer of customs, to grant such licence, except upon certificate of the proper officer of the customs, (and if he shall judge it necessary, one or more person or persons skilled in the building and surveying of ships) that he or they has or have surveyed the said vessel, in the presence of the master or owner, and that he or they has or have found that the scantling of her timbers, and the description of her fastenings, are of the size and description as hereinafter mentioned; that is to say, if the vessel shall be 50 tons, and not exceeding 100 tons, that the scantling of her timbers shall be [here insert the scantling of the different description of timbers], and that she shall be fastened, [here insert the different description of fastenings] if 100 tons, and not exceeding 150 tons; if 150 tons, and not exceeding 200 tons, (and so on to as high a rate of tonnage as may be deemed necessary) and that such vessel is seaworthy and properly found in all respects.

That the licence continue in force for one year only.

That steam passage-vessels, built prior to the passing of this Act, if the scantling of their timbers do not exceed in size one-half the dimensions required by the Act, according to the tonnage, the owners of such vessels shall, before a licence be granted to convey passengers in such vessel, be required to add to their strength [here describe the additional strength required]

If the scantling of timbers do not exceed - - - 3
Ditto - - - ditto - - - 4
and so on.

That carrying passengers without such license, the master or owner shall, for every offence, forfeit the sum of pounds.

(A.)

Builder's Certificate.

In this document I propose to insert the size and strength of the ship's timbers, fastenings, &c.—J.C.

THIS is to certify that the _____ called the _____ of _____ whereof _____ is at present master; British built at _____ having deck, and _____ mast, being in length from the fore part of the main stem to the after part of the stern post aloft _____ feet _____ inches; in breadth at the broadest part the main wales _____ feet _____ inches; her depth of hold _____ feet _____ inches, and admeasures _____ tons, being a _____ with a stern, and having _____ gallery, and _____ figure head, was launched on the _____ day of _____ 1831, and that _____ is the first purchaser.

(signed) _____ Ship Builder.

(B.)

Surveyor's Certificate of Admeasurement.

In this document I also propose to insert the size and strength of the ship's timbers and fastenings, with the addition that they are of the size and strength required (by such an Act of Parliament) according to her tonnage.—J.C.

Port of _____ No. _____ THIS is to certify that the ship or vessel called the _____ of _____ burthen _____ tons, whereof _____ is at present master built, has _____ decks and _____ masts; that her length from the fore part of the main stem to the after part of the stern post aloft, is _____ feet _____ inches, her breadth at the broadest part _____ feet _____ inches, her * _____ feet _____ inches, that she is _____ rigged, with a _____ bowsprit, is _____ sterned, _____ built, has _____ galleries, figure head, and appears to be the same vessel described in the _____ dated the _____

* Here insert "height between decks," or "depth in hold," if only one deck.

† Here insert Builder's Certificate, or Judge's Certificate, or last Registry.

Or in a special certificate for obtaining a licence for the conveyance of passengers.—J.C.

Given under my hand at the Custom-house, this _____ day of _____ in the year _____ Keel for tonnage _____ feet _____ inches. I do hereby on the part of the owners of the _____ being thereto duly authorized by _____ consent and agree to the several particulars set forth in the above description and admeasurement.

DEPOSITIONS taken before the Coroner's Inquest, relative to the loss of the *Rothsay Castle* Steam Boat.

Appendix, No. 4.

" Sir,

" Caernarvon, 31st August 1831.

" IN compliance with your request I enclose for Viscount Melbourne's information a copy of the depositions taken by me, at an inquest held on view of two bodies who perished in the *Rothsay Castle*, on the 17th instant. Llanfairfechen being a long distance from Beaumaris, where the surviving passengers landed, I had not an opportunity of examining more than three witnesses. The coroner for the borough of Beaumaris was on the spot, and I doubt not that he will be able to furnish you with more accurate information respecting this unfortunate occurrence.

" I have the honour to be, Sir, your obedient humble servant,

" Ed. Carreg,

" G. Lamb, Esq.

" Coroner for the County of Caernarvon."

" Carnarvonshire, } INFORMATIONS of witnesses taken at the parish Church of Llanfair-
to wit. } fechen, in the county aforesaid, this 19th day of August 1831, before
Edward Carreg, coroner for the said county, touching the death of Mr. — Duckworth,
and a man unknown, then and there lying dead, as follow :

" Robert Whittaker sworn, saith that he, with two of his children and sister were passengers on board the *Rothsay Castle* steam packet, plying between Liverpool and Beaumaris. The *Rothsay Castle* started about eleven o'clock in the morning of Wednesday the 17th instant, for Liverpool. There were about a hundred passengers on board, and the weather was not boisterous when the anchor was weighed. The packet proceeded along the river Mersey several miles, without encountering any interruption from the state of the weather, but when she was out of the river and had got into the Channel, the wind became higher, and several of the passengers entreated Captain Atkinson, who commanded the packet, to return to Liverpool, to which he replied that there was not the slightest danger, and proceeded on his voyage to Beaumaris. About two o'clock the Captain retired into his cabin to dinner, where deponent thinks he might have remained about two hours. Deponent thinks that Captain Atkinson when he returned on deck appeared a little in spirits, but cannot swear that he was intoxicated. The vessel proceeded at a slow rate, the weather becoming tempestuous and the wind contrary, till she got opposite Puffin's Island, when she struck upon a sand bank called the Dutchman's Bank, and in about an hour afterwards she became a perfect wreck. The crew and passengers, with the exception of about 20 people, all perished.

" Robert Whittaker."

" William Hughes sworn; saith that he was a seaman on board the *Rothsay Castle*, and has served with Captain Atkinson for the last two years. The captain understood the navigation of the coast from Liverpool to Beaumaris well, and deponent thinks there was not the slightest blame attached to him for bad seamanship; but considers that he had drank rather too much, although he cannot swear that he was intoxicated.

The mark of

" William + Hughes."

" Evan Evans sworn; saith that he was a sailor on board the *Rothsay Castle*, and corroborates the statement of the last witness. Deponent further states that although he considered that the captain was a little affected with drink, still he was not incapacitated from performing his duties from intoxication.

" Evan Evans."

" Verdict of the jury :—Accidental death, by being wrecked at sea.

" The above informations were severally taken the day, year and place above stated before

" Ed. Carreg, Coroner."

A SURVEY on the shattered remains of the hull of the steam packet *Rothsay Castle*, now at Conway, viz.:

Outside planks, thickness as under,

Deal planks	-	-	-	-	-	-	-	-	1 ½ inch.
Ditto	-	-	-	-	-	-	-	-	1 ¾ to 2 inch.
1 American birch	-	-	-	-	-	-	-	-	2 ½ inch with spikes.
Top timbers	-	-	-	-	-	-	-	-	3 ½ to 4 ½ which ought to be 4 ½ to 5 ½
2d. futtock	-	-	-	-	-	-	-	-	4 ½ - 5 — 5 ½ - 6 ½
1st. futtock head	-	-	-	-	-	-	-	-	5 — 7 ½

Few new top timbers fastened with iron spikes, bolts in the inside, binding strake ½ of an inch, planks 3 inch.

(signed)

" Robert Roberts."

" The above-named Robert Roberts, ship carpenter of Conway, deposes upon oath, before me, John Owen, clerk, one of His Majesty's Justices of the Peace for the county of Carnarvon, that to the best of his judgment the timbers above specified were much too light for a vessel of the tonnage of the *Rothsay Castle*.

" Robert Roberts."

" Sworn before me this 26th day of August 1831.

" John Owen."

Appendix, No. 4.

"William Jones and Robert Owen of Beaumaris, ship carpenters, state that they went over to Carnarvonshire the 25th day of August 1831, to examine part of the wreck of the Rothsay Castle steam packet; that they saw part of her quarter-deck, the carlings of which were of American oak, and measured 14 feet in length, and five inches square; the quarter-deck planks were of fir timber, two inches thick, and the main-deck planks, 2 ½ inches thick; carlings under the fore part of the main deck as far as where the paddles worked, 4 ½ inches by 3 ½, very much split by nails; the knee near where the main beam was, is of deal timber, and measures four feet in length, and the foot of it two feet, and in depth 4 ¾ inches. The length of the upper works of her quarter-deck is 22 feet 3 inches, planked under the gunwale with 1 ¾ inch deal plank. Fore and aft piece under the carlings 3 inches thick, not dove-tailed, top string outside bolted to it all along, without any knees, there were six new top timbers of deal, 4 ½ inches square; also six new top timbers of oak, about same size as deal ones, none of the new top timbers were fastened with trannels but with spikes; old top timber (old frame) of oak, 4 ½ inches square; stern frame 6 inches square; several loose top timbers about same dimensions as those already mentioned; outside plank of deal, 2 inches thick under the beam. On the 27th instant they examined another part of the wreck which was on the Dutchman's Bank, her wing timbers of oak, 4 inches by 5. The length of her main transom is 10 feet 4 inches, breadth 5 inches, and in depth 6 inches, and is quite rotten; there is a piece of oak fastened to it inside, 7 inches broad and 8 inches deep, having an iron knee at each end; futtocks of oak in length 6 feet, breadth 5 ½ inches by 4 ½; second futtocks, in length 5 feet, and in breadth 5 inches by 4 ½; top timbers of oak, 5 ½ inches by 3 ½. The main beam is 8 inches in breadth, and 17 inches in depth, with deal knees each side; bottom planks of American elm 2 ½ inches thick; keelson of deal, 1 foot square; floor timbers of oak, the largest they could see was 7 ½ inches in breadth, and 8 ½ inches in depth on the keel. That she was planked with deal and elm planks of the aforesaid dimensions, and fastened with spikes and a few trannels, that from the new timbers found in her she appeared to have been recently repaired, most of the old timber which they saw was in a very bad state, and much of it rotten. That the vessel appeared to them to have been very slightly built, and that in their opinion, neither her new nor old timbers were strong enough for a vessel of a larger burthen than from 40 to 50 tons. And also, that had all her timbers been in a sound state, they would have been much too weak for her size and engine.

"William Jones."

Witness,

"Jno. Griffith."

The mark of

"Robert + Owen."

"Borough of Beaumaris, } THE examination of William Jones, fireman, taken in writing
to wit. } upon oath, this 18th day of August 1831; Who saith that the Rothsay Castle steam packet left Liverpool yesterday morning, at 11 o'clock, the wind at north, and blowing hard, had a great number of passengers, upwards of 100; the vessel made much water during the passage, the water came through her sides, the pumps were choked, began to pump about 10 o'clock at night, before they made the Ormeshead; the water was up to witness's ankles when he fed the fire; it blew so strong that we could not gain Ormeshead before 10 o'clock; the engine is one 50 horse power, cannot say what her tonnage was. Pumped altogether, but the water gained upon them. Cannot say whether the steam was up when the vessel struck, did not hear it: has been employed on board the Rothsay Castle three weeks; the vessel is very strong; the water came in through the shaft in the paddle-box; the vessel struck upon the sands near the Puffin Island, near 12 o'clock. Do not know whether there was any ballast on board; 50 horse power is not sufficient to face such a sea as was running at the time, the sea was running very high; the captain ordered to reverse the engine after the vessel struck three or four times, could just see the Puffin Island; the bow was raised about a couple of yards when she struck; most of the passengers were washed overboard when the vessel struck; witness made for the foremast when the vessel struck, and remained there until picked up by a boat. Mr. Jones and his wife are among the dead; Mr. Jones was steward; Jones said, when off Ormeshead, that he knew quite well they should never reach shore; heard several passengers ask the captain to put back to Liverpool, as they knew they should never reach shore; one passenger offered two sovereigns if he would put him on shore; neither the captain nor mate were sober, both were evidently drunk before they reached Ormeshead; the pumps were choaked by the ashes; the captain ordered witness to cramb the fire when it did not require it. The seamen did not appear at all alarmed before the vessel struck. Has seen the 17 corpses lying dead, and has no doubt they were passengers on board of the Rothsay Castle yesterday; thinks the lives of the passengers might have been saved if they had put back to Liverpool. Is a fireman, and no seaman; few of the passengers asked the captain to cast anchor, and he answered, Hold your bother, there is no danger. Were two men short of a full crew; two men left at Bangor, and their places were not supplied.

(signed)

The mark + of the said

"William Jones."

Sworn before me

"Thomas Williams, Coroner."

"On his examination on the 19th he states, that the steam was up when the vessel struck; the steam failed between Ormeshead and Puffin Island. Witness went to assist the engineer when the steam failed; the other fireman was in the forecabin; the steam failed in consequence of the coal being so wet; the water came in through the shaft; the sea was very rough at the time; the vessel was as strong a one as witness ever saw.

"T. W."

"Borough of Beaumaris, } THE examination of William Hughes, seaman, taken in writing
to wit. } upon oath, this 18th day of August, 1831: Who states that they had another seaman, himself, carpenter, two firemen, mate and engineer; short of one, but thinks there were sufficient to work the vessel; she is not a stout boat; the sea ran very heavy, and the vessel's side was to the sea; was at the wheel when the vessel struck; the engine stopped in the smoothing opposite the Old Tower, in consequence of water; the water came in through her seams; she laboured hard; that could not have been the case if she was sea-worthy; did not think her not sea-worthy before; she dragged a considerable distance before she struck with a reversed engine; she dragged about a mile. The mate took the wheel out of witnesses hands, and put it hard a-starboard, which sent the vessel further on the bank; when the accident took place the captain was fresh; and the mate no better; the steam failed and the vessel was driven on the bank; if the anchor had been let down when she first grounded she would have been saved; the dead bodies were passengers on board the *Rothsay Castle* yesterday, as witness believes.

Before me,
"Thomas Williams, Coroner."

The mark of the said
"William + Hughes."

On board: Captain Atkinson; mate, William Battlestone; William Hughes, seaman; Evan Evans, seaman; carpenter; William Goose, engineer; John Jackson, fireman; William Jones, fireman; steward, under-steward, and black boy.

"Borough of Beaumaris, } THE examination of William Jones, a pilot of Liverpool, No. 7,
to wit. } states upon oath, that he was a passenger on board of the *Rothsay Castle* yesterday; about half-past seven some passengers asked the captain to put back, but he refused; were then between the two Ormesheads; was in bed when the vessel first struck; were near the Dutchman's Bank at the time; she struck very hard on the Dutchman; asked to put up a light, but the mate said that was no business of mine; she is a very old vessel and very cranky; was in bed when she struck; the captain gave his orders distinctly. Witness advised to hoist the jib, and the mate said, What is that to you; the vessel went to the south and east of the buoy; would have turned back when the vessel struck if left to his own judgment; the vessel struck about 50 times before the captain gave orders to reverse; was asleep when the vessel first struck; got a-leeward of the right course before the vessel struck; the vessel ought not to have got to leeward if they had kept the proper course; it was in consequence of bad steering; the corpses now lying dead were passengers on board of the *Rothsay Castle* yesterday.

Before me,
"Thomas Williams, Coroner."

"William Jones."

"Borough of Beaumaris, } THE examination of Evan Evans, seaman, taken in writing on
to wit. } oath, this 18th day of August 1831: Who saith that he was at the wheel a considerable part of the voyage from Liverpool to Beaumaris; she leaked so much between Ormeshead and Puffin Island that the steam quite failed; the water came in partly through the seams, and partly from breaking over the deck; were on the weather edge of the bank when they struck; does not think the captain or mate were sober.

Before me,
"Thomas Williams, Coroner."

"Evan Evans."

"Borough of Beaumaris, } THE examination of Elliot Rudland, musician, taken in writing
to wit. } upon oath, this 18th day of August 1831: Who states that he heard some of the passengers ask the captain to ring the bell, and he said, There is the bell, and go ring it yourself. He was not fresh, as witness believes; he was calm at the time the vessel struck; cannot say how many hands there were on board; they have been changed so frequently of late: thinks all the bodies now lying dead were passengers on board of the *Rothsay Castle* yesterday.

Before me,
"Thomas Williams, Coroner."

"Elliot Rudland."

"Borough of Beaumaris, } THE examination of William Watson, of Liverpool, in the
to wit. } county of Lancaster, merchant, taken in writing, upon oath, this 19th day of August 1831, before me, Coroner for our Lord the King for the said borough, and the liberties and precincts thereof: Who saith that he is proprietor of the *Rothsay Castle*: she started from Liverpool on the 17th, about half-past 10 o'clock, with about 92 passengers, and a crew of 15. The captain has power to discharge men; does not do so without witness's knowledge; did not know that the crew was short when the vessel started on the 17th. Cannot say how many there were on board as a crew on the 17th; the vessel was on the slip about four days, to get a new boiler; purchased the vessel at the Clyde; thinks she is 10 years old; may be 16 years old; never heard that she had been condemned. Has never heard that the crew had occasion to repair the vessel on the passage from Beaumaris to Liverpool, any further than the boiler; Wilson repaired her; never heard any one complain that the vessel was extremely weak. Some of the ballast was left in the vessel; did not hear that the vessel heaved on one side in smooth water; did not hear that she was the weakest vessel out of Liverpool; the engine is a 58 horse power.

Cautioned by
Coroner not to
answer any ques-
tions which may
criminate himself.

Sworn before me
"Thomas Williams, Coroner."

"William Watson."

Appendix, No. 4. "Borough of Beaumaris, } THE examination of Henry Wilson, of Manchester, taken in
to wit. } writing upon oath, this 19th day of August 1831: Who saith that
the *Rothsay Castle* started on the 17th a full hour behind the time she professed to start.
Went on well to the *Rock light-house*; after dinner got into a heavier sea, and the captain
minded nothing but drinking, and spoke in a foolish and frivolous way. He was drunk,
and the mate also. He, the captain, gave no direct answer; thinks that both captain and
mate thought we were in a hopeless condition, and never expected to reach land long
before we left *Ormeshead*. There was water in the gentlemen's cabin before the vessel
struck. Heard the captain frequently asked to put out lights, but he refused; he also
refused to allow the bell to be rung, but that was done contrary to his orders.

Sworn before me,

(signed)

"*Henry Wilson.*"

"*Thomas Williams, Coroner.*"

"Borough of Beaumaris, } THE examination of Robert Whittaker, of Bury, taken in writing,
to wit. } upon oath, this 19th day of August 1831: Who saith that he was
a passenger on board of the *Rothsay Castle*, on the 17th; heard several passengers ask the
captain to return to *Liverpool*, long before they came to the *Ormeshead*, but he answered
that he ought to know what to do better than they. Witness was one to work at the
pump because there was a little water in the hold; the captain, witness thought, was not
quite sober. Saw a person on board attempt to assist the captain in working the vessel,
and he was not sober; witness asked the captain to hoist a light and fire a gun, and he said
he had none; saw no gun on deck; captain said he had no lantern; captain said there was
no danger; when she struck again, the sea broke over, and loosened the stays of the
chimney; Mr. Terry, a passenger, frequently asked, "where is the captain?" the answer
was always "the captain is at dinner;" this answer was given for above two hours; the
captain seemed stupified and sulky after dinner; some one connected with the vessel told
the witness that he was frightened when he saw the water coming through the cabin
floor.

"Sworn before me, *Thomas Williams, Coroner.*"

"*Robert Whittaker.*"

"Borough of Beaumaris, } THE examination of George Hammond, of Leeds, taken in
to wit. } writing, upon oath, this 19th of August 1831: Who states that he is
in the habit of going a good deal by steam packets; was quite satisfied with the conduct of
the captain and mate until about four o'clock; they remained at dinner about two hours;
after a dinner the vessel appeared to be making no way, and the captain was requested to
turn back; the vessel was labouring very hard; is conversant with machinery; thinks the
generality of steamers would have weathered the sea then running; there was a want of
discipline on board; thinks that if the captain and mate had attended to their duty, or
turned back to *Liverpool*, the vessel would have been saved; the water rolled about in the
gentlemen's cabin about an hour before the vessel struck; thinks that not a tenth part of
the water then in the vessel came through the aperture in the shaft, but must have come
through the seams.

"Sworn before me *Thomas Williams, Coroner.*"

"*Geo. Hammond.*"

LETTER from the Provost of Glasgow to Lord Viscount Melbourne.

My Lord,

Glasgow, 2d September 1831.

IN compliance with yours of the 29th ult. I now enclose copy of our last Act for improving the navigation of the river Clyde, which is the only one that bears on the objects your Lordship seems to have in view. You have, however, the titles of our former Acts. I enclose also two copies of our bye-laws and regulations. I beg likewise to send your Lordship an extract from the only legal proceedings that took place here respecting the *Rothsay Castle* steam vessel. Should you wish to institute any farther inquiries, I believe all the parties interested in that process, with the exception of Turner, are here, and will be ready to give any further information required.

On hearing of the loss of the *Rothsay Castle* steam-boat, I suggested to the Committee of the River Trust to appoint two engineers, two carpenters and two shipmasters to inspect the whole of the steam-boats belonging to this port. The investigation is still going on; but I learn that several vessels have been withdrawn, and put under repair, before being submitted to survey. This shows very strongly the advantages that would arise from some general legislative measure as to the surveying of steam vessels.

Should Government contemplate any such enactment I shall feel pleasure in procuring such information as the great intercourse in steam navigation on the Clyde may enable me to supply.—I have the honour to be, my Lord, your Lordship's most obedient servant,

Robert Dalglish, Provost.

LETTER from Mr. David Napier to John Richardson, Esq.

Dear Sir,

Glasgow, October 3d, 1831.

I WAS not at home on Sunday, and did not receive your letter until late this evening. The *Rothsay Castle* steamer was built in the beginning of the year 1816. She has been lengthened and altered several times since that. She was built for the purpose of plying betwixt this and *Rothsay*. I did not think her fit for anything but breaking up when she was bought last year by the *Liverpool Company*. I perfectly recollect of Mr. Hamilton, their agent here, calling on me, to get my opinion of what she was worth, when I referred him to the bakers, considering her only fit for burning; still it was possible to fit her out, and make her seaworthy, but I did not think her worth the expense.—I am, dear Sir, your's, truly,

To John Richardson, Esq.

(signed) *David Napier.*

Appendix, No. 5.

PETITION of *Cadogan Williams*, to the Honourable House of Commons.

Appendix, No. 5.

TO the Honourable the Commons of the United Kingdom of Great Britain and Ireland, in Parliament assembled.

The humble Petition of *Cadogan Williams*;

Sheweth,

THAT your petitioner having conceived a plan by which the safety of ships might be increased, came to London, in 1814, for the purpose of getting it adopted. That your petitioner understanding that the Right Honourable Charles Earl of Stanhope, since deceased, might be disposed to give your petitioner, though a stranger, the benefit of his advice in the business, your petitioner took the liberty to solicit an interview, and submitted the proposition to his Lordship, which proposition was that each ship should be divided into four water-proof compartments, so that if a leak were to spring in either of them, it would not always endanger the safety of the ship, as her buoyancy would not be diminished one-third with some description of cargo; and in this reasoning his Lordship concurred, and said he had proposed a similar plan to the Lords of the Admiralty, except that it recommended a division of the vessel into thirteen compartments instead of four. That your petitioner afterwards submitted the said plan to the Honourable the East India Company, which was by them referred to Captain Boulderson, who told your petitioner it would interfere too much with the stowage in Indiamen; adding, that it was more likely to succeed in ships of war, in which the space for stowage was not so great an object of consideration. Your petitioner does further beg to suggest, that he understands the principle of his plan is acted upon in the vessels that bring the live salmon from Scotland to London, and by the Chinese, in their vessels called junks. Your petitioner does therefore pray that your Honourable House will take the fore-mentioned plan of your petitioner, for increasing the safety of steam vessels, into their consideration.

And your petitioner will ever pray, &c.

September 24, 1831.

(signed)

Cadogan Williams.

Appendix, No. 6.

LETTER from Captain *K. B. Martin*, on the Comparison of Steam Packets with Sailing Crafts as formerly employed in the Conveyance of Passengers on the Thames, &c. &c.

Appendix, No. 6.

COMPARISON OF STEAM PACKETS with SAILING CRAFTS as formerly employed in the Conveyance of Passengers on the Thames, &c. &c.

WHILE it is admitted that great inconvenience arises continually to passage wherries and working craft upon the Thames, from the undulation of the waters consequent to the progress of steam vessels, still we are bound to recollect, that before their introduction the sailing packets were also continually and seriously complained of. I commanded sailing packets from the year 1814 (five years) to 1819; in that short period I witnessed many very serious accidents, and several times attended with loss of life. I have commanded steam vessels 11 years since that period, and, fortunately for me, have not witnessed an accident attended with loss of life to any individual. In those days it was not uncommon to see a fleet of us tacking to and fro in the Pool, striking loaded barges, carrying away each other's gear, and not unfrequently maiming our passengers. A gentleman had his leg torn off by a hawser on board the *Grand Falconer*; the *Rose* in June ran into a tier, carried away every thing by the board, and severely injured several passengers; the *Duke of Wellington* ran over a wherry, and drowned both the people in her. I have seen a *Gravesend* boat drive through the centre arch of the bridge, and the mast toppled down upon deck among the passengers. But the vessels cease to exist as packets, and their casualties and misfortunes are forgotten, except by those who sailed in them. The melancholy event of the *Rothsay Castle* steam packet still wounds our feelings, and meets our eye with '*fresh particulars*' in every newspaper: but the loss of the *Berwick* smack upon the *Nore* sand; of the *British Queen* upon the *Goodwin*, (where not a soul of either passengers or crew escaped to tell the tale); the *Curtis* at *Ostend*; and many others I could enumerate, have, in a few years, passed into comparative oblivion. That steam vessels are safer than other packets can be proved to demonstration, particularly when placed in careful and skilful hands. The *James Watt* made her passage from *Edinburgh* during a gale which drove on shore 43 sail of merchant vessels. His Majesty's steam vessel, *African*, run on shore upon the *Goodwin*; the first sea that struck her shattered her stern frame, and knocked her rudder off. A sailing vessel, in half an hour, would have been a wreck, and all hands lost. The *African* backed off by the power of her engines, and came into the harbour of *Ramsgate*. But to return to the Thames, and the present day. His Majesty's steam vessel, *Pluto*, ran down a barge, and drowned a part of the crew. On Saturday the 10th of this month the brig *Lucia*, of *Yarmouth*, run down the smack *Rodney*, of *Rochester*, and drowned a part of the crew. The one is made the subject of a court martial, and the theme of the daily press; the other is barely noticed. If those hue and cry gentlemen of the press are to hunt

Appendix, No. 6.

us down by false and exaggerated statements, no respectable man will command a steam packet.

It may be well not to allow them to race down the Pool in full speed in competition with each other; but to restrain them to four knots an hour would expose them to greater mischief, and their passengers to consequent danger. The Pool, at times, is not so wide as the vessels are long; what is to become of them if they fall athwart in a strong tide? the mischief and damage would be incredible. Who could contemplate the throwing down a steam packet's chimney without horror, perhaps upon a deck crowded with 400 passengers? The smoke and fire would rush out from the furnaces, and the volumes of steam from the boiler, among a group the half of whom might be driven overboard; hence it becomes necessary at times to shoot through these narrow places with increased velocity. The blow of a sailing barge, a smack or lighter, would, if touching upon either bow or quarter, cant them into the tier, either on one side or the other. The Pool ought never to be less than 100 yards in width, and a collier dock would be the best remedy; then place a row of small buoys on each side; and every vessel lying moored outside of them should receive no compensation for damage incurred, but liable to a penalty, if continuing more than one tide in so improper a situation. As respects the wherries, one half their accidents arise from their own fool-hardiness. They know we have a beautiful machine that we can stop at an instant; and they sheer closer to our bows and paddle-boxes than to a vessel sailing, taunting us continually with the most brutal and indecent language. Watermen's boys row out into the back-water of our wheels, to have what they call a toss, thus exposing themselves to unnecessary danger, and alarming the passengers on board the steam packet. I could enumerate a long list of passage boats and wherries upset by sailing vessels; indeed they are unsafe in the rippling of a strong breeze. On the 6th of April 1829 one of these boats swamped in Limehouse Reach, just below the Pool, *from that cause alone*; and five shipwrights and the waterman were drowned. In July, same year, two females were drowned by the upsetting a watch-boat at Gravesend. In June, the present year, a lady and gentleman were drowned by sailing across the bows of a Prussian ship in a small boat in Halfway Reach. In July following five persons were drowned in Woolwich Reach by the upsetting a pleasure boat. A few days after three young men were drowned in Erith Reach by the upsetting of a small skiff.

Who will say, with truth, that the accidents by steam vessels will bear any sort of proportion, when the number of voyages they make, and the passengers they carry, are taken into consideration. I have, in 11 years, had under my care nearly 100,000 persons, not one of them received the slightest injury; and, in conclusion, I beg leave to submit to your Honourable Committee, that no man has greater inducements to be careful than the captain of a steam packet. His freight is human life; and his emoluments depend upon his character for sobriety, carefulness and attention. I have the honour to subscribe myself your most obedient servant,

(signed) K. B. Martin.

Appendix, No. 7.

Appendix, No. 7.

LETTER from John Barrow, Esq. to Colonel Sibthorp, enclosing Letter from Lieut. Stevens; dated 14th October 1831.

Sir,

Admiralty Office, 14th October 1831.

I AM commanded by my Lords Commissioners of the Admiralty to send you, for the information of the Committee of the House of Commons on Steam Vessels, copy of a letter from Lieutenant Stevens of the Royal Marine Artillery, stating, that he has fabricated an improved blue light, which he conceives would be useful on board those vessels.

I am, Sir, your most obedient humble servant,

Colonel Sibthorp, M. P.

John Barrow.

Sir,

Portsmouth, 11th October 1831.

HAVING noticed an account of some experiments stated to have been made by a Committee from the House of Commons, in conjunction with several distinguished naval officers, relative to navigating steam vessels, I beg respectfully to request that you will be pleased to state to my Lords Commissioners of the Admiralty, that I have some time since prepared for experiment a peculiar sort of blue light, which I think may perhaps find a useful application in the above description of vessels, by rendering such distressing accidents as have occurred less likely to happen.

If their Lordships should be pleased to direct any trial of these lights, they can be brought or sent as they may order; and as they are already made, no expense would be incurred in fabrication.

I beg to add, that the ordinary blue light will burn less than one minute; and those I have made will burn five, with equal brilliancy with the former.

I have the honour to be, Sir, &c.

(signed) J. H. Stevens,

Capt. the Hon. G. Elliot, C. B.

Lieut. R. M. Artillery.

Appendix, No. 8.

DESCRIPTION of a FENDER to prevent the effect of Collision in Steam Vessels.

Appendix, No. 8.

SIR,

16, Lloyd Square, Pentonville.

IN conformity to the Instructions we received at the Committee of The House of Commons, we have the honour to submit a description of a Fender for the purpose of preventing the effect of Collision in Steam Vessels, as well as to protect a vessel from speedily going to pieces by striking against rocks or sand-banks; the same answering for a life-raft on occasions.

The machine may be formed of either three or five spars, planks, studding sail booms, capstan-bars, or sweeps. A machine of this nature would require but a very short time to make up; but if it should be formed of *five* spars, be kept ready prepared, and, with the lashings, it would admit of being suspended astern, and would consequently not prove cumbersome in the least degree; from its lightness would be very portable and render it fit for use in the short space of one minute. We believe few, who have seen models of the invention, will contest its efficacy for the proposed end, as nothing of the same bulk and lightness could offer such a degree of resistance and elastic force. The three spars crossing each other and being placed at right angles present the six ends to the shock in the most advantageous position possible for resistance, and each end being sustained by eight stays of strong rope, it would consequently require a force capable of breaking twenty-four ropes, being half the number of ropes lashing the machine, and three strong spars, before the fender would yield to the violence of the shock by collision. The fender composed of five spars would require a longer time to make it sea-worthy, but it would possess the advantage of protecting a larger portion of the vessel from concussion.

As it is impossible to convey an adequate idea of the manner of forming these machines and making use of them, in writing, we are prepared to give every requisite explanation of them, when called for, by means of models, and will, if necessary, give *practical* demonstration on the river of their efficiency; awaiting the commands of Your Honourable Committee,

We have the honour to be, Sir, Your most obedient and most humble servants,

Alfred Canning & Co.

Appendix, No. 9.

H. M. Steam Vessel Lightning, Woolwich, 8 October 1831.

THE LIGHTNING'S RATE OF GOING, when Six Inches deeper than when the Honourable Committee were embarked on board her, on Thursday the 6th instant.

Appendix, No. 9.

Day Tried.	Power of the Engine.	Rate of Miles per Hour.	Revolutions per Minute.	TIDE.	WIND.
Saturday, 8 Oct. 1831	Whole	7 $\frac{1}{8}$	23	against -	-- against; fresh breeze.
- — -	ditto	8	22 $\frac{1}{2}$	with -	ditto; ditto.
- — -	ditto	8	23	against -	- - ditto; light breeze.
- — -	Half	5 $\frac{1}{2}$	14	slack -	ditto.
- — -	Two-thirds	6 $\frac{1}{2}$	17	— -	ditto.
- — -	Three-fourths	7	19	against -	light.

REMARKS.—Thirty tons of coals and about two tons of water were taken on board the Lightning to bring her down six inches deeper than on Thursday last; namely, from 9 ft. 10 in. to 10 ft. 4 in.; and it is very observable that she makes a greater wake, and spreads the sea much more from the quarters. The rate of going is taken with the same log and glass as on Thursday, which gives a little short of the true distance; I should think about 1-16th less.

John Allen, Master.

Appendix, No. 10.

Appendix, No. 10. A STATEMENT of DAMAGES done at different times to the Ballast Lighters, Barges, and Boats belonging to the Honourable Corporation of Trinity House, by Steam and also by Sailing Vessels.

DAMAGES DONE BY STEAM VESSELS.

DATE when they Occurred.	NAME of STEAM VESSEL that did the Damage.	To what Lighter, Barge or Boat.	Where the Occurrence took place.
1826 :			
August - - 19	James Watt - -	Barge, No. 3 - -	Blackwall.
September - - 2	Lord Melville - -	Lighter, No. 4 - -	Limehouse.
October - - 10	Attwood - -	Ditto, No. 21 - -	Pool.
1827 :			
May - - - 10	George the Fourth - -	Lighter, No. 35 - -	Ditto.
June - - - 28	Dart - - -	Boat, No. 26 - -	Ditto.
--- - - 30	Royal Sovereign - -	Barge, No. 11 - -	Ditto.
December - - 20	Ariadne - -	Machine's Boat - -	Limehouse.
1828 :			
September - 18	Dart - - -	Lighter, No. 10 - -	Pool.
December - - 29	Venus - - -	Ditto, No. 26 - -	Ditto.
1829 :			
April - - - 25	Yorkshireman - -	Boat, No. 30 - -	Duke Shore, Limehouse.
May - - - 6	Shannon - -	Lighter, No. 12 - -	Limehouse.
June - - - 10	Dart - - -	Ditto, No. 10 - -	Pool.
- - - - -	Hero - - -	Ditto, No. 28 - -	Ditto.
July - - - 29	Kent - - -	Ditto, No. 38 - -	Ditto.
September - 15	Graham - -	Ditto, No. 28 - -	Duke Shore, Limehouse.
October - - 22	Pearl - - -	Ditto, No. 38 (sunk) - -	Greenwich.
1830 :			
February - - 1	Essex - - -	Boat, Barge, No. 4 - -	Woolwich Reach.
April - - - 23	Kent - - -	Lighter, No. 17 - -	Bugby's Reach.
June - - - 1	Sophia Jane - -	Lighter, No. 7 - -	Greenwich.
--- - - 7	Royal George - -	Barge, No. 11 - -	Pool.
July - - - 30	Royal George - -	Ditto, No. 5 - -	Woolwich Reach.
August - - 18	Batavier - -	Ditto, No. 2 - -	Greenwich.
September - 16	Columbine - -	Lighter, No. 14 - -	Deptford.
October - - 16	Kent - - -	Boat, No. 31 - -	Pool.
December - 17	Mountaineer - -	Lighter, No. 33 - -	Ditto.
1831 :			
March - - 15	Harlequin - -	Barge, No. 9 - -	Pool.
- - - 22	Queen of Scotland - -	Lighter, No. 16 - -	Charlton
June - - - 27	Royal Adelaide - -	Ditto, No. 20 - -	Pool.
July - - - 26	Meteor - - -	Ditto, No. 31 - -	Ditto.
August - - 2	Essex - - -	Barge, No. 12 - -	Below Greenwich.
September - 12	Magnet - - -	Lighter, No. 40 - -	Pool.

DAMAGE DONE BY SAILING VESSELS.

1826 :			
March - - 10	Jane & Mary - -	Lighter, No. 4 - -	Galleons.
- - - 14	Carnation - -	Ditto, No. 35 - -	Ditto.
April - - 5	Elizabeth & Mary - -	Boat, No. 33 - -	Deptford.
- - - 26	Susan - - -	Barge, No. 1 - -	In the Pool.
May - - 12	X. L. - - -	Lighter, No. 1 - -	Deptford.
- - - 22	Minerva - -	Ditto, No. 29 - -	In the Pool.
July - - 19	Hebbon Hall - -	Ditto, No. 11 - -	Ditto.
August - - 1	Contest - -	Ballast Machine - -	Blackwall.
September - 7	Conference - -	Lighter, No. 26 - -	In the Pool.

Damage done by Sailing Vessels—continued.

Appendix, No. 10.

DATE when they Occurred.	NAMES of VESSELS that did the Damage.	To what Lighter, Barge or Boat.	Where the Occurrence took place.
October - - 12	Glasgow - - -	Ditto, No. 19 - -	Barking.
- - - 25	Elbe - - -	Ballast Machine -	Blackwall.
- - - 26	Vine - - -	Lighter, No. 30 -	In the Pool.
November - 4	Friends - - -	Barge, No. 4 - -	Limehouse.
- - - 14	Venerable - - -	Ditto, No. 3, (one man drowned).	Blackwall.
- - - 20	Courier - - -	Lighter, No. 24 -	Duke Shore, Limehouse.
December - 6	Columbus - - -	Ditto, No. 31 - -	Charlton.
- - - 30	Ann - - -	Ditto, No. 25 - -	In the Pool.
- - - -	Bensley, E. I. C. Hoy	Ditto, No. 35 - -	Limehouse Reach.
1827:			
January - - 1	Minerva - - -	Lighter, No. 9 - -	In the Pool.
- - - 17	Prince of Waterloo -	Ditto, No. 30 - -	Limehouse Reach.
- - - 18	Pursuit - - -	Ballast Machine -	Greenwich.
February - - 10	Fifeshire - - -	Lighter, No. 22 -	Limehouse.
March - - 3	Blakeney Packet -	Barge No. 1 - -	Greenwich.
- - - 10	Loyal Standard -	Ballast Machine and Barge No. 6.	Ditto.
- - - 21	Good Intent - - -	Barge No. 5 - -	In the Pool.
April - - 12	Polly - - -	Ballast Machine -	Greenwich.
- - - 28	Fidelity - - -	Ditto - - -	Ditto.
May - - 30	Julia - - -	Barge No. 1 - -	Ditto.
June - - 10	Wilhelmina - - -	Ballast Machine -	Ditto.
July - - 5	Eliza - - -	Ditto - - -	Top of Blackwall Reach
August - - 2	Briton - - -	Lighter No. 13 - -	Bugby's Reach.
- - - 31	Hero - - -	Ditto No. 8 - -	In the Pool.
September - 1	Britannia - - -	Ditto No. 25 and 35 -	Bugby's Reach.
- - - 4	Cumberland - - -	Barge, No. 5 - -	Limehouse Reach.
- - - 11	Providence - - -	Lighter, No. 9 - -	Limehouse.
- - - 16	Isabella - - -	Ditto, No. 20 - -	Deptford.
October - - 15	Blue Eyed Lass -	Ditto, No. 29 - -	In the Pool.
December - 19	Resolution - - -	Barge, No. 11 - -	Limehouse Reach.
- - - 30	Richard & Thomas -	Ballast Machine -	Ditto.
1828:			
January - - 2	Perseverance - - -	Ditto - - -	Ditto.
- - - 8	Dauntless - - -	Lighter, No. 23 -	In the Pool.
February - - 9	Sutton - - -	Ballast Machine -	Limehouse Reach.
March - - 5	Unity - - -	Ditto - - -	Ditto.
- - - 27	William Tell - - -	Ditto - - -	Ditto.
April - - 13	Endeavour - - -	Ditto - - -	Ditto.
- - - 24	Eucharis - - -	Lighter, No. 16 -	Galleons.
May - - 4	Erin - - -	Ballast Machine -	Limehouse Reach.
- - - 15	Zealous - - -	Lighter, No. 29 -	In the Pool.
- - - 17	Cygnus - - -	Barge, No. 4 - -	Blackwall.
September - 17	Adamant - - -	Lighter, No. 20 -	Charlton.
- - - 25	Emma - - -	Ballast Machine -	Limehouse Reach.
October - - 9	Resolution - - -	Lighter, No. 26 -	In the Pool.
- - - 11	Salus - - -	Ballast Machine -	Blackwall.
- - - 28	Mary - - -	Lighter, No. 28 -	Limehouse Reach.
November - 10	Friends of Eliza -	Ditto, No. 41 - -	Blackwall.
- - - 14	Three Sisters - - -	Ditto, No. 9 - -	Limehouse Reach.
December - 9	Symmetry - - -	Barge, No. 11 - -	In the Pool.
- - - 10	Nereus - - -	Ditto, No. 9 - -	Greenwich.
1829:			
January - - 5	Courier - - -	Ditto, No. 3 - -	In the Pool.
March - - 2	Uncertain - - -	Lighter, No. 41 -	Charlton.
- - - 6	Elizabeth - - -	Barge, No. 10 - -	Duke Shore, Limehouse.
- - - 31	Diana - - -	Lighter No. 28 -	In the Pool.
May - - 11	Bell & Ann - - -	Ditto No. 9 - -	Limehouse Reach.
June - - 25	Loyalty - - -	Barge No. 3 - -	Ditto.
September - 2	Jean - - -	Lighter No. 7 - -	Galleons.
- - - 4	Lord Gambier - - -	Ballast Machine -	Woolwich Reach.
- - - 16	Ann & Elizabeth -	Barge No. 1 - -	Limehouse Reach.
- - - 28	Thomas & Robert -	Ditto, No. 4 - -	Blackwall.
October - - 24	Lady Delavel - - -	Ditto, No. 12 - -	In the Pool.
December - 10	Providence - - -	Ballast Machine -	Woolwich Reach.

Appendix, No. 10.

Damage done by Sailing Vessels—*continued.*

DATE when they Occurred.	NAMES of VESSELS that did the Damage.	To what Lighter, Barge or Boat.	Where the Occurrence took place.
1830 :			
January - 17	Hope - - -	Ballast Machine -	Woolwich Reach.
February - 19	Diana - - -	Lighter, No. 5 -	In the Pool.
March - 6	St. Helena - -	Ditto, No. 23 -	Deptford.
- - 15	Esther - - -	Ballast Machine -	Woolwich Reach.
- - 19	Eclipse - - -	Barge, No. 3 -	Cuckold's Point.
May - 4	Olive - - -	Lighter, No. 3 -	Bugby's Reach.
- - 18	Catherine - -	Ditto, No. 2 -	Limehouse.
- - 28	Henry - - -	Ballast Machine -	Woolwich Reach.
July - 28	Navarino - -	Barge, No. 3 -	Ditto.
August - 19	Le Medusa - -	Ballast Machine -	Charlton.
September 1	Edinbro' Castle -	Lighter, No. 33 -	In the Pool.
November - 17	Starling - - -	Ballast Machine -	Bugby's Reach.
December - 2	Equity - - -	Lighter, No. 37 -	Galleons.
1831 :			
January - 4	Roberts - - -	Ditto, No. 35 -	Galleons.
February - 17	Amphitrite - -	Ditto, No. 32 -	DukeShore, Limehouse.
March - 22	Barbara - - -	Ballast Machine -	Bugby's Reach.
- - 26	Britannia - - -	Lighter, No. 35 -	Galleons.
- - 29	Peace - - -	Ditto, No. 14 -	Blackwall.
April - 1	Perseverance - -	Ditto, No. 23 -	In the Pool.
- - 7	Endeavour - - -	Barge, No. 4 -	Blackwall Reach.
- - 30	Ibbetson - - -	Lighter, No. 39 -	Bugby's Reach.
May - 4	Prince Regent -	Ditto, No. 38 -	In the Pool.
June - 12	Paragon - - -	Barge, No. 1 -	Bugby's Reach.
- - 13	Susan - - -	Ballast Machine -	Ditto.
- - 15	Mary Ann - - -	Lighter, No. 5 -	In the Pool.
July - 1	Cumberland - -	Ditto, No. 35 -	Greenwich.
- - 6	Heart of Oak - -	Barge, No. 9 -	Galleons.
August - 27	Thomas & Ann -	Barge Boat, No. 3 -	Blackwall.
- - 30	Ellen - - -	Ballast Machine -	Galleons.
September - 1	Iris - - -	Lighter, No. 28 -	Deptford.

Wm. Honeyman,
Principal Ruler.

A LIST of the STEAM VESSELS Navigating the River *Thames*, with the Dates of Increase of number.

Vessels belonging to the PORT of LONDON on the 31st December 1830; viz.

Soho.	London.	Nottingham.
Tourist.	Swiftsure.	Dairy Maid.
City of Edinburgh.	Sons of Commerce.	Endeavour.
James Watt.	Diana.	Superb.
Queen of the Netherlands.	City of London.	Dart.
Druid.	Emulous.	Mercury
King of the Netherlands.	Sir Joseph Yorke.	Courier.
Talbot.	Gauga Saugor.	Victory.
Mountaineer.	Sir Edward Banks.	Pearl.
Favorite.	Royal Sovereign.	Kent.
Waterloo.	Malvina.	Essex.
Enterprize.	Enterprize.	Albion.
Eclipse.	Harlequin.	Eclipse.
Belfast.	William Jolliffe.	Ramona.
Rapid.	Hawk.	Fly.
Brocklebank.	Venus.	Magnet.
Earl of Liverpool.	Columbine.	William the Fourth.
Attwood.	Eclipse.	Emma.
Lord Melville.	Hero.	Sophia Jane.

Note.—Forty-two of these vessels navigated the River *Thames* during the year 1830; the remaining 15 were either laid up or employed at other ports.

VESSELS belonging to other PORTS Navigating the *Thames*, during the year 1830:

Appendix, No. 10.

Superb - - - of Cork.	Yorkshireman - - } of Hull.
Erin - - - - of Belfast.	Prince Frederick - }
Shannon - - - }	Queen of Scotland } of Aberdeen.
Thames - - - - } of Dublin.	Duke of Wellington }
City of Londonderry }	United Kingdom - of Glasgow.
	Batavia - - - Foreign vessel.

ABSTRACT, showing the Number of VESSELS belonging to the PORT of LONDON,
with the Dates of Increase of number.

YEARS.				VESSELS.			
In the year	-	-	1814	-	-	-	Nil.
—	-	-	1815	-	-	-	1
—	-	-	1816	-	-	-	2
—	-	-	1817	-	-	-	3
—	-	-	1818	-	-	-	6
—	-	-	1819	-	-	-	7
—	-	-	1820	-	-	-	9
—	-	-	1821	-	-	-	16
—	-	-	1822	-	-	-	22
—	-	-	1823	-	-	-	26
—	-	-	1824	-	-	-	29
—	-	-	1825	-	-	-	44
—	-	-	1826	-	-	-	59
—	-	-	1827	-	-	-	59
—	-	-	1828	-	-	-	57
—	-	-	1829	-	-	-	61
—	-	-	1830	-	-	-	57

Note.—There are no documents in this department by which such vessels as navigated the *Thames* can be distinguished for the above periods, previous to the year 1830.

Office of Reg^r Gen^l of Shipping, }
Custom House, London, 1 Oct. 1831. }

John Covey,
Reg^r Gen^l of Shipping.

Appendix, No. 11.

SPECIFICATION of DIMENSIONS and SCANTLINGS adapted for the Construction of STEAM VESSELS of the FIRST CLASS, which are intended for the Conveyance of Goods and Passengers; calculated to insure their safety in dangerous Navigation against the consequences of striking the Ground, or from a heavy Sea.

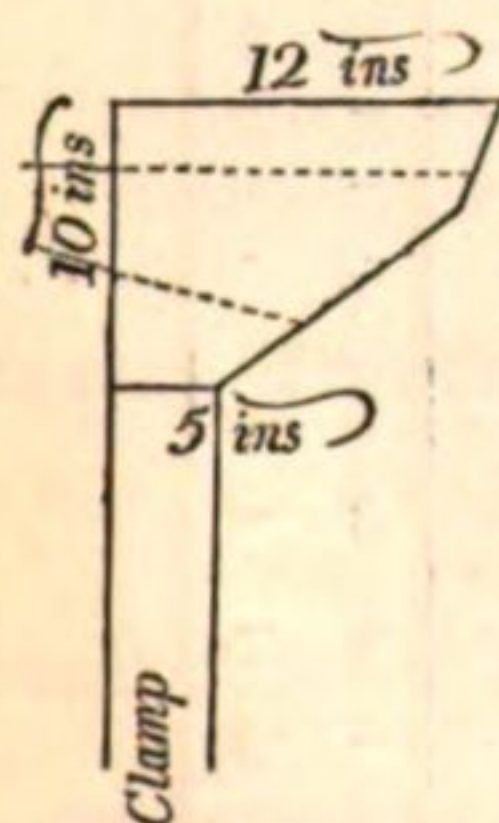
Steam Vessels intended to navigate Rivers, or for short voyages on the Coast, may be Planked inside and out with Baltic Fir or Red Pine, without endangering their safety.

PARTICULARS.	Materials.	700 Tons.		500 Tons.		300 Tons.		200 Tons.		150 Tons.	
		—	Diam ^r of Bolts.	—	Diam ^r of Bolts.	—	Diam ^r of Bolts.	—	Diam ^r of Bolts.	—	Diam ^r of Bolts.
KEEL: To be in midships - - sided	English elm	ft. in.	inches.	ft. in.	inches.	ft. in.	inches.	ft. in.	inches.	ft. in.	inches.
at the fore end - - sided	- - -	1 2	- -	1 1	- -	1 1	- -	1 0	- -	1 0	- -
at the post - - sided	- - -	1 1	- -	1 0 $\frac{1}{2}$	- -	1 0	- -	9	- -	8	- -
below the rabbet - - deep	- - -	1 4	- -	1 3	- -	1 2	- -	1	- -	11 $\frac{1}{2}$	- -
The scarphs to be not less than long	- - -	9	- -	9	- -	8	- -	7	- -	6	- -
to be dowelled or tabled into each other, and laid with felt.	- - -	3 8	- -	3 6	- -	3	- -	3	- -	2 10	- -
Bolted with six bolts - - -	- - -	- -	$\frac{7}{8}$	- -	$\frac{7}{8}$	- -	$\frac{7}{8}$	- -	$\frac{7}{8}$	- -	$\frac{3}{4}$
FALSE KEEL: if required - - thick	English elm	- 3	- -	- 3	- -	- 3	- -	- 3	- -	- 3	- -
STEM: In one or two pieces free from sap or defects of any kind,											
at the head - sided	English oak	1 1	- -	1 -	- -	1 1	- -	1 0	- -	9 $\frac{1}{2}$	- -
at the heel - sided	- - -	1 1	- -	1 0	- -	1 0	- -	9	- -	8 $\frac{1}{2}$	- -
and before the rabbet - moulded	- - -	1 3	- -	1 2	- -	1 -	- -	1 0	- -	10	- -
the scarphs to be - - long	- - -	6	- -	6	- -	6	- -	5	- -	5	- -
dowelled or tabled into each other, and laid with felt. Bolted with six bolts	- - -	3 6	- -	3 6	- -	3 4	- -	3 2	- -	3 -	- -
	- - -	- -	$\frac{7}{8}$	- -	$\frac{7}{8}$	- -	$\frac{7}{8}$	- -	$\frac{3}{4}$	- -	$\frac{3}{4}$
APRON: Sided same as the stem moulded	English oak	- 9 $\frac{1}{2}$	- -	- 9	- -	- 8	- -	- 7 $\frac{1}{2}$	- -	- 7	- -
STEMSON: Scarphed on the fore end of the keelson - - -	- Ditto.										
at the lower end to be - sided	- - -	1 0	- -	1 0	- -	1 0	- -	9 $\frac{1}{2}$	- -	9	- -
at the upper end - - sided	- - -	1 -	- -	1 0	- -	1 0	- -	9 $\frac{1}{2}$	- -	9	- -
	- - -	9	- -	9	- -	8 $\frac{1}{2}$	- -	8	- -	7	- -
	- - -	8	- -	8	- -	7 $\frac{1}{2}$	- -	7	- -	6	- -
STERN POST: Free from sap or defects of any kind - - -	{English oak, or African.										
at the head - - square	- - -	1 1	- -	1 -	- -	1 0 $\frac{1}{2}$	- -	1 0	- -	9	- -
fore and aft on the keel - - -	- - -	1 6	- -	1 5	- -	1 3	- -	1 2	- -	1 2	- -
abaft the rabbet at the wing transom - - -	- - -	7	- -	7	- -	6	- -	6	- -	6	- -
- - ditto - on the keel - - -	- - -	1 -	- -	1 1	- -	1 0 $\frac{1}{2}$	- -	1 0	- -	9	- -
INNER POST: To run up to the under side of wing transom - - -	{English oak, or African.										
fore and aft at the head - - -	- - -	8	- -	7	- -	6 $\frac{1}{2}$	- -	6	- -	6	- -
- ditto - on the keel - - -	- - -	1 2	- -	1 1	- -	1 -	- -	1 0	- -	10	- -
WING TRANSOM - - - sided	{English oak, or African.										
in midships - - - moulded	- - -	1 4	- -	1 3	- -	1 1	- -	1 1	- -	10	- -
at the ends - - - moulded	- - -	1 1	- -	1 0	- -	9	- -	8 $\frac{1}{2}$	- -	8	- -
Secured with an iron knee at each end; the fore and aft arm to have four bolts, one in each timber, and three bolts in the thwartship arm - -	- - -	- -	1	- -	$\frac{7}{8}$	- -	$\frac{7}{8}$	- -	$\frac{7}{8}$	- -	$\frac{3}{4}$
through the transom; all to be well clenched on rings.	- - -	- -	- -	- -	$\frac{7}{8}$	- -	$\frac{7}{8}$	- -	$\frac{3}{4}$	- -	$\frac{3}{4}$
The transom to be bolted to the stern post with two bolts - - -	- - -	- -	1	- -	$\frac{7}{8}$	- -	$\frac{7}{8}$	- -	$\frac{7}{8}$	- -	$\frac{3}{4}$
To have no other transom, but all the timbers to be dowelled at their heads to the under side of the wing transom, and bolted at their heels through each other across the deadwood, with bolts	- - -	- -	$\frac{7}{8}$	- -	$\frac{7}{8}$	- -	$\frac{7}{8}$	- -	$\frac{3}{4}$	- -	$\frac{3}{4}$

PARTICULARS.	Materials.	700 Tons.		500 Tons.		300 Tons.		200 Tons.		150 Tons.	
		—	Diam ^r of Bolts.	—	Diam ^r of Bolts.	—	Diam ^r of Bolts.	—	Diam ^r of Bolts.	—	Diam ^r of Bolts.
		ft. in.	inches.	ft. in.	inches.	ft. in.	inches.	ft. in.	inches.	ft. in.	inches.
DEADWOOD: Sided the same as the keel, but may be reduced in the cant body two inches on each side above the stepping line. To be wrought up to the seats of the floor timbers, and forward and abaft sufficiently high for the security of the heels of the cant timbers. To have a knee of English oak or iron against the stern-post, the fore and aft arm to be scarphed on the after-piece of keelson - - - to be long sided and bolted two feet apart with bolts -	English oak.	8 -	- -	8 -	- -	7 -	- -	6 -	- -	6 -	- -
		- 10	- -	- 10	- -	- 9	- -	- 8	- -	- 8	- -
		- -	1	- -	1	- -	1	- -	$\frac{7}{8}$	- -	$\frac{7}{8}$
The lower piece of deadwood may be English elm, to have a tenon into the inner post; all above the lower piece to be - - - - -	Oak.										
KEELSON: In midships - - square	{ African or English oak. }	1 1	- -	1 -	- -	- 10	- -	- 9 $\frac{1}{2}$	- -	- 9	- -
to taper at the fore end to	-	- 10	- -	- 10	- -	- 9	- -	- 8	- -	- 8	- -
at the after end to	-	- 10	- -	- 10	- -	- 9	- -	- 8	- -	- 8	- -
To be bolted through every floor timber with bolts clenched on a ring at each end - - - - -	-	- -	$1\frac{1}{8}$	- -	$1\frac{1}{8}$	- -	1	- -	$\frac{7}{8}$	- -	$\frac{7}{8}$
the scarphs to have three dowels, and be - - - - - long	-	4 6	- -	4 6	- -	4 2	- -	4 -	- -	4 -	- -
to be six feet clear of the heel of the masts and of the scarphs of the keel.											
FASHION PIECES: To be double - sided the foremost one to run up above the wing transom - - - - -	English oak.	- 9	- -	- 9	- -	- 8	- -	- 7	- -	- 6	- -
and be dowelled to its end.	-	2 9	- -	2 8	- -	2 -	- -	1 10	- -	1 8	- -
The after one to run up to the under side of the wing transom, and be dowelled into it.											
KNIGHTHEADS: At the head - sided	{ English oak or African. }	1 -	- -	1 -	- -	- 10	- -	- 9	- -	- 8	- -
to be coaked to the stem and apron, and bolted athwartships - - -	-	- -	1	- -	1	- -	$\frac{7}{8}$	- -	$\frac{7}{8}$	- -	$\frac{3}{4}$
HAWSE PIECES: To have on each side											
number	-	three.	- -	three.	- -	three.	- -	two.	- -	two.	- -
sided	Ditto.	- 11	- -	- 11	- -	- 10	- -	- 10	- -	- 10	- -
to run up to within one foot of the top of the knighthead; the hawse holes fitted with cast iron hawse pipes to be diameter	-	- 10	- -	- 9	- -	- 8	- -	- 7	- -	- 6	- -
ROOM and SPACE to be, the whole length of the engine-room - - -	-	2 -	- -	1 10 $\frac{3}{4}$	- -	1 10 $\frac{1}{2}$	- -	1 9	- -	1 8	- -
to be increased forward and abaft to -	-	2 2	- -	2 2	- -	2 - $\frac{1}{2}$	- -	1 9	- -	1 8	- -
CROSS PIECES or SHORT FLOORS: In the engine-room - - - sided	Ditto.	- 11	- -	- 10 $\frac{3}{4}$	- -	- 10	- -	- 8 $\frac{1}{2}$	- -	- 8	- -
forward and abaft - - - sided	-	- 10	- -	- 9 $\frac{1}{2}$	- -	- 9	- -	- 7	- -	- 6	- -
at the cutting down - - moulded	-	1 2	- -	1 -	- -	- 10 $\frac{1}{2}$	- -	- 9	- -	- 8 $\frac{1}{2}$	- -
and may be increased as the rising of the floor may require.											
At the heads to be - - moulded	-	- 10	- -	- 9 $\frac{1}{2}$	- -	- 8 $\frac{3}{4}$	- -	- 7	- -	- 6 $\frac{1}{2}$	- -
N. B. If the vessel be flat-floored, a cross-piece and long floor to be adopted to avoid a middle line joint or butt.											
HALF FLOORS: In the engine-room											
to be - - - - sided	Ditto.	- 10	- -	- 10	- -	- 9 $\frac{1}{2}$	- -	- 7 $\frac{1}{2}$	- -	- 7	- -
forward and abaft - - - sided	-	- 9	- -	- 9	- -	- 8 $\frac{1}{2}$	- -	- 6	- -	- 5 $\frac{1}{2}$	- -
at the heads - - - moulded	-	- 9	- -	- 8	- -	- 7	- -	- 6	- -	- 5 $\frac{1}{2}$	- -

PARTICULARS.	Materials.	700 Tons.		500 Tons.		300 Tons.		200 Tons.		150 Tons.	
		—	Diam ^r of Bolts.	—	Diam ^r of Bolts.	—	Diam ^r of Bolts.	—	Diam ^r of Bolts.	—	Diam ^r of Bolts.
		ft. in.	inches.	ft. in.	inches.	ft. in.	inches.	ft. in.	inches.	ft. in.	inches.
LOWER FUTTOCKS: In wake of the paddle beams - - - sided	{English oak or African}	- 9 $\frac{1}{2}$	- -	- 9	- -	- 8 $\frac{1}{2}$	- -	- 7	- -	- 6 $\frac{1}{2}$	- -
forward and abaft - - - sided		- 8 $\frac{1}{2}$	- -	- 8	- -	- 7	- -	- 6	- -	- 5	- -
at the heads - - - moulded		- 8	- -	- 7	- -	- 6	- -	- 5 $\frac{1}{2}$	- -	- 5	- -
SECOND FUTTOCKS and TOP TIMBERS:											
In wake of the paddle beams - sided	- Ditto -	- 9 $\frac{1}{2}$	- -	- 9	- -	- 8	- -	- 6	- -	- 6	- -
forward and abaft - - - sided	- - -	- 8	- -	- 7 $\frac{1}{2}$	- -	- 7	- -	- 5 $\frac{1}{2}$	- -	- 5	- -
at the gunwale - - - moulded	- - -	- 4 $\frac{1}{2}$	- -	- 4	- -	- 4	- -	- 3 $\frac{1}{2}$	- -	- 3 $\frac{1}{2}$	- -
FRAME: To be - - - - -	{English oak or African teak.}										
All the timbers of the frame to be put together with dowels, uniting their heads and heels, and bolted together at their sides with two bolts of - - - in each scarph. The chocks or fillings put in the openings to receive the frame bolts, to be oak, and not split out after the frames are in their places, as is the present practice in His Majesty's dock-yards.		- -	$\frac{3}{4}$	- -	$\frac{3}{4}$	- -	$\frac{3}{4}$	- -	$\frac{5}{8}$	-	$\frac{5}{8}$
The cross-pieces and half-floors or long floors, to make a close joint, and their sides to be dowelled together. The frame to be opened above the cross-pieces and the half-floor heads, by making the levelling edges straight lines. Those openings immediately under the paddle beams, and for two feet on each side of those beams, to be filled in solid down to the bilge. And the whole of the openings to be filled in solid from the keel to the turn of the bilge, and to be caulked both within and without-board. If it be desirable to build the vessel light, the fillings may be Baltic fir; if not, and the holding-down bolts pass through the bottom, they had better be oak in the engine-room; a water-course of two inches should be left in every other one.											
MAIN WALES: To be - - - broad	{English oak or African}	4 2	- -	3 4	- -	2 9	- -	2 6	- -	2 6	- -
number of strakes - - - -		five	- -	four	- -	three	- -	three	- -	three	- -
thick		- 6	- -	- 5	- -	- 5	- -	- 4	- -	- 3 $\frac{1}{2}$	- -
May have one dowel in the timber next the butt.											
THICKSTUFF: under the main wales, number of strakes - - - -	- Ditto -	three	- -	two	- -	two	- -	one	- -	one	- -
together - - - - broad	- - -	2 6	- -	1 10	- -	1 8	- -	- 11	- -	- 10	- -
thick	- - -	- 5	- -	- 4	- -	- 4	- -	- 3	- -	- 3	- -
above the main wales, number of strakes	- - -	one	- -	one	- -	one	- -	one	- -	one	- -
broad	- - -	- 10	- -	- 10	- -	- 10	- -	- 10	- -	- 10	- -
thick	- - -	- 5	- -	- 4	- -	- 4	- -	- 3	- -	- 2 $\frac{1}{2}$	- -
and one strake upon that - broad	- - -	- 10	- -	- 10	- -	- 10	- -		- -		- -
thick	- - -	- 4	- -	- 3	- -	- 3	- -		- -		- -
TOPSIDES: The number of strakes as may be required.											
each strake - - - - broad	- Ditto	- 7	- -	- 7	- -	- 7	- -	- 7	- -	- 7	- -
thick	- - -	- 3	- -	- 2 $\frac{1}{2}$	- -	- 2 $\frac{1}{2}$	- -	- 2 $\frac{1}{2}$	- -	- 2	- -
SHEER STRAKES - - - - number	- Ditto -	two	- -	two	- -	one	- -	one	- -	one	- -
together - - - - broad	- - -	1 8	- -	1 8	- -	1 -	- -	- 11	- -	- 10	- -
thick	- - -	- 4	- -	- 4	- -	- 4	- -	- 3	- -	- 3	- -

PARTICULARS.	Materials.	700 Tons.		500 Tons.		300 Tons.		200 Tons.		150 Tons.	
		—	Diam ^r of Bolts.	—	Diam ^r of Bolts.	—	Diam ^r of Bolts.	—	Diam ^r of Bolts.	—	Diam ^r of Bolts.
		ft. in.	inches.	ft. in.	inches.	ft. in.	inches.	ft. in.	inches.	ft. in.	inches.
PLANK OF THE BOTTOM: To be English oak or African teak - - thick down to lightwater mark, from thence to the turn of the bilge to be Dantzic oak, and from the turn of the bilge to the keel to be English elm.	{ English oak or African. }	- 4	- -	- 3	- -	- 3	- -	- 2½	- -	- 2½	- -
Every butt to be bolted with bolts of - to be well clenched on the inner end.	- - -	- -	¾	- -	¾	- -	¾	- -	⅝	- -	⅝
GARBOARD STRAKE: To be - thick broad	English elm	- 7	- -	- 6½	- -	- 6	- -	- 5	- -	- 4	- -
to be bolted through each other across the keel, at about three feet apart, and up and down through the half floors with bolts - - -	- - -	1 2	- -	1 2	- -	1 -	- -	- 11	- -	- 11	- -
to be well clenched with a ring on each end.	- - -	- -	¾	- -	¾	- -	¾	- -	¾	- -	¾
COUNTER: Plank - - - thick	{ English oak or African. }	- 3	- -	- 3	- -	- 2½	- -	- 2½	- -	- 2	- -
PLANSHEER OR GUNWALE: To be thick plank within board.	- - -	- 4	- -	- 4	- -	- 3	- -	- 2½	- -	- 2½	- -
THICKSTRAKES ON THE FLOOR HEADS: To have at the floor heads - number together - - - broad thick	- Ditto -	three	- -	three	- -	three	- -	one	- -	one.	- -
may be diminished at the fore and after ends to - - - number and diminished to - - - thick	- - -	2 6	- -	2 6	- -	2 6	- -	1 -	- -	1 -	- -
to be bolted through every third timber with bolts - - -	- - -	- 6	- -	- 5½	- -	- 4½	- -	- 4	- -	- 4	- -
and to have treenails in the other timbers.	- - -	two	- -	two	- -	two	- -	one	- -	one.	- -
	- - -	- 4	- -	- 3½	- -	- 3	- -	- 3	- -	- 3	- -
	- - -	- -	¾	- -	¾	- -	¾	- -	¾	- -	¾
ENGINE BEARERS: To have two on each side, well dowelled into the timbers, and bolted, the whole length of the engine-room, through every other timber, with bolts - - -	African teak	- -	1½	- -	1½	- -	1½	- -	1	- -	7⁄8
forward and abaft, with bolts - -	- - -	- -	1	- -	1	- -	1	- -	7⁄8	- -	7⁄8
The engine bearers should be made of the longest trees that can be obtained, the scarphs - - - long and placed clear of each other.	- - -	4 6	- -	4 6	- -	4 -	- -	3 9	- -	3 6	- -
Sided sufficient to suit the stand of the engine, and of depth to admit of the outside vibrating beam to work clear of the inside plank.	- - -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -
May be reduced before and abaft the engine-room in the moulding to moulded	- - -	- 6	- -	- 6	- -	- 5	- -	- 4	- -	- 4	- -
SHELF PIECES: To receive the ends of the upper deck beams - deep in midships - broad	{ English oak or African. }	- 10	- -	- 9	- -	- 7½	- -	- 5	- -	- 4	- -
may be tapered close forward and aft to - -	- - -	1 -	- -	1 -	- -	1 -	- -	- 10	- -	- 9	- -
not to be dowelled, but scored over every timber, and alternately bolted at three inches from the upper and lower edges, one bolt in every timber of -	- - -	- 9	- -	- 9	- -	- 9	- -	- 8	- -	- 8	- -
	- - -	- -	7⁄8	- -	7⁄8	- -	7⁄8	- -	¾	- -	¾
CLAMP UNDER THE SHELF PIECE: Number of strakes - - - together - - - broad thick	{ English oak or African. }	three	- -	three	- -	three	- -	two	- -	two	- -
to have one long length under the paddle beams - - - thick	- - -	2 9	- -	2 6	- -	2 6	- -	1 10	- -	1 8	- -
The clamp may be reduced in thickness, close forward and aft, to - thick in addition to the treenail fastening, to have through every third timber one bolt well clenched - - -	- - -	- 5	- -	- 5	- -	- 4½	- -	- 3	- -	- 2½	- -
	- - -	- 7	- -	- 6½	- -	- 5	- -	- 4	- -	- 3	- -
	- - -	- 4	- -	- 3½	- -	- 3	- -	- 2½	- -	- 2	- -
	- - -	- -	7⁄8	- -	¾	- -	¾	- -	⅝	- -	⅝



PARTICULARS.	Materials.	700 Tons.		500 Tons.		300 Tons.		200 Tons.		150 Tons.	
		—	Diam ^r of Bolts.	—	Diam ^r of Bolts.	—	Diam ^r of Bolts.	—	Diam ^r of Bolts.	—	Diam ^r of Bolts.
		ft. in.	inches.	ft. in.	inches.	ft. in.	inches.	ft. in.	inches.	ft. in.	inches.
STRAKE UNDER THE CLAMP: To receive the ends of the diagonal - thick	{ English oak or African. }	4	-	4	-	3	-	2½	-	2½	-
trusses or braces - - - broad		10	-	10	-	9½	-	9	-	8	-
DIAGONAL IRON PLATES: To lay them at an angle of 45° - - - broad	-	4	-	4	-	3½	-	3	-	3	-
scored into the timbers the whole thickness - - - thick	-	5	-	5	-	9	-	1½	-	3	-
to be placed - - - apart	-	1 10	-	2	-	2 6	-	3	-	3 6	-
to be in length from the under part of the shelf-piece down to receive two bolts through the cross-piece or short floors. Bolted through every timber with bolts - - -	-	-	¾	-	¾	-	¾	-	5/8	-	5/8
And at the middle of the body to have a diagonal triangle let into and bolted through every timber, the same as the diagonal plates.	-	-	-	-	-	-	-	-	-	-	-
DIAGONAL PLANK: Of dry seasoned English oak or African,	-	-	-	-	-	-	-	-	-	-	-
in midships - thick	-	4	-	4	-	3	-	2½	-	2	-
broad	-	11	-	10	-	10	-	10	-	10	-
may be reduced in thickness, close forward and aft, to - thick	-	2½	-	2½	-	2½	-	2	-	2	-
to be placed in the engine-room apart	-	1 6	-	1 6	-	1 8	-	1 8	-	1 8	-
forward and abaft apart	-	1 8	-	1 8	-	2 -	-	2 -	-	2 -	-
	-	2 -	-	2 -	-	2 4	-	2 6	-	2 6	-
All the fastening of the bottom to be driven through, and additional bolts added if required. And between the plank to be filled in with 1 ¼ inch rabbeted deal, flush with the diagonal plank, the whole length of the engine-room.	-	-	-	-	-	-	-	-	-	-	-
CABIN PLATFORMS: Beams - square	Baltic fir	6	-	6	-	5	-	4	-	4	-
secured to the side by an angular shelf, with one bolt in each end, of -	-	-	¾	-	¾	-	¾	-	¾	-	¾
Flat to be laid with deal - thick	-	1½	-	1½	-	1½	-	1½	-	1½	-
MAIN BEAMS TO PADDLE WHEEL:	-	-	-	-	-	-	-	-	-	-	-
To be - - - sided	African teak	1 2	-	1 2	-	1 1	-	9½	-	9	-
in midships - - - moulded	-	1 6	-	1 5	-	1 4	-	1 -	-	11	-
at the ship's side - - - ditto	-	1 4	-	1 3½	-	1 2½	-	11	-	10	-
at the ends - - - ditto	-	1 2	-	1 2	-	1 1	-	9½	-	9	-
IRON KNEES TO PADDLE BEAMS:	-	-	-	-	-	-	-	-	-	-	-
Within-board, side arm - - long	-	5 -	-	5 -	-	5 -	-	4 -	-	3 -	-
beam arm - - - long	-	4 6	-	4 6	-	3 10	-	3 6	-	3 -	-
- - - broad	-	4	-	4	-	3½	-	3	-	3	-
in the throat - - - thick	-	4	-	4	-	3½	-	3	-	3	-
tapered to the ends - - thick	-	1½	-	1½	-	1½	-	1¼	-	1	-
bolted with - - -	-	-	1¼	-	1¼	-	1½	-	1	-	7/8
IRON KNEES TO PADDLE BEAMS:	-	-	-	-	-	-	-	-	-	-	-
Without-board, side arm - long	-	6 -	-	5 6	-	5 -	-	4 -	-	3 -	-
beam arm - - - long	-	7 -	-	5 6	-	5 -	-	4 6	-	4 -	-
- - - broad	-	5½	-	5	-	4½	-	4	-	3½	-
in the throat - - - thick	-	5½	-	5	-	4½	-	4	-	3½	-
tapered to the ends - - thick	-	1½	-	1¼	-	1	-	7/8	-	¾	-
to be bolted with - - -	-	-	1¼	-	1¼	-	1½	-	1	-	7/8
STAYS TO PADDLE BEAMS - diameter	Iron	4	-	3½	-	3	-	2½	-	2	-
SPRING BEAM: to support the paddle shaft - - - sided	{ African teak or English oak }	1 -	-	11	-	9	-	7	-	6	-
	-	1 6	-	1 5	-	1 4	-	1 3	-	1 2	-

PARTICULARS.	Materials.	700 Tons.		500 Tons.		300 Tons.		200 Tons.		150 Tons.	
		—	Diam ^r of Bolts.	—	Diam ^r of Bolts.	—	Diam ^r of Bolts.	—	Diam ^r of Bolts.	—	Diam ^r of Bolts.
		ft. in.	inches.	ft. in.	inches.	ft. in.	inches.	ft. in.	inches.	ft. in.	inches.
SPONCING: In those that are built with an increased breadth upon deck, beyond the vessel's side, the timbers to be, sided placed one against the side of each upper deck beam and bolted thereto; the heels of them bolted to the side with planked with fir - - - thick	English oak	- 7	-	- 6½	-	- 5½	-	- 5	-	- 5	-
	- - -	-	7/8	-	7	-	7/8	-	5/4	-	3/4
	- - -	- 2½	-	- 2½	-	- 2	-	- 2	-	- 2	-
	- - -	-	3/4	-	3/4	-	3/4	-	3/4	-	3/4
A thickstrake of English oak or African teak let on one half of the moulding of the sponcing timbers to meet the waterway (a piece of felt being first placed in the joint), and bolted through each other, with one bolt through the timber and one between each timber, well clenched - - - The beam ends secured to this strake by a dovetail dog-bolt; the plate or tail part of the bolt to be let into the beam and secured with a bolt and a nail.	- - -	-	3/4	-	3/4	-	3/4	-	3/4	-	3/4
	- - -	-	3/4	-	3/4	-	3/4	-	3/4	-	3/4
	- - -	-	3/4	-	3/4	-	3/4	-	3/4	-	3/4
	- - -	-	3/4	-	3/4	-	3/4	-	3/4	-	3/4
UPPER DECK BEAMS: To round in four feet - - - sided to be in midships - - - moulded abaft and before the engine room sided moulded to be secured to shelf with two bolts and one dowel at each end.	{ English oak or African. }	- 1	-	- 1	-	- 1	-	- 1	-	- 1	-
	- - -	- 9	-	- 8½	-	- 8	-	- 6½	-	- 6	-
	- - -	- 7½	-	- 7	-	- 6½	-	- 5	-	- 5	-
	- - -	- 7½	-	- 7	-	- 7	-	- 5½	-	- 5	-
If the vessel is built with spongings the beams must be continued over the gunwale to the breadth of the sponging, and do not require any knees. If the vessel is built without spongings, the beams must be kneed at each end with one hanging and one lodging knees.	- - -	- 7	-	- 6½	-	- 6	-	- 4½	-	- 4½	-
	- - -	-	3/4	-	3/4	-	3/4	-	5/8	-	5/8
	- - -	-	3/4	-	3/4	-	3/4	-	5/8	-	5/8
	- - -	-	3/4	-	3/4	-	3/4	-	5/8	-	5/8
WATERWAY: Dantzic fir - - broad thick	- - -	- 11	-	- 11	-	- 10	-	- 10	-	- 10	-
	- - -	- 5	-	- 5	-	- 4½	-	- 4	-	- 4	-
FLAT OF THE DECK - - thick	Dantzic deal	- 3	-	- 3	-	- 3	-	- 2½	-	- 2½	-
ROUGHTREE TIMBERS; At the gunwale sided moulded rail - - - sided moulded	{ English oak or African. }	- 7	-	- 7	-	- 6	-	- 5	-	- 5	-
	- - -	- 4½	-	- 4½	-	- 4	-	- 3	-	- 2½	-
	- - -	- 5	-	- 5	-	- 4½	-	- 4	-	- 4	-
	- - -	- 3½	-	- 3½	-	- 3	-	- 3	-	- 2½	-
Height from the upper side of the deck to the upper side of the rail - -	- - -	4 6	-	4 6	-	3 5	-	3 -	-	3 -	-
	- - -	-	-	-	-	-	-	-	-	-	-
TOWING TIMBERS: Two on each side sided moulded	{ English oak or African. }	1 2	-	1 2	-	1 -	-	- 11	-	- 10	-
	- - -	- 8	-	- 7½	-	- 7	-	- 6½	-	- 6	-
BREASTHOOKS: Forecastle deck hook sided one between that and upper deck sided upper deck hook - - sided one at the platform deck - sided in the hold - - - number sided all except the deck hooks may be of iron - - - broad in the throat - - - thick at the ends - - - thick each arm - - - long bolts - - -	English oak	- 7	-	- 6½	-	-	-	-	-	-	-
	- Ditto -	- 8	-	- 8	-	-	-	-	-	-	-
	- D tto -	- 9	-	- 8½	-	- 7½	-	- 6	-	- 6	-
	- Ditto -	- 9	-	- 8½	-	- 8	-	- 7	-	- 6	-
all except the deck hooks may be of iron - - - broad in the throat - - - thick at the ends - - - thick each arm - - - long bolts - - -	- Ditto -	three	-	three	-	three	-	three	-	two.	-
	- - -	- 10	-	- 10	-	- 9	-	- 9	-	- 8	-
	- - -	- 4	-	- 4	-	- 3½	-	- 3	-	- 3	-
	- - -	- 3½	-	- 3½	-	- 3	-	- 2½	-	- 2½	-
bolts - - -	- - -	- 1¼	-	- 1¼	-	- 1¼	-	- 1	-	- 1	-
	- - -	8	-	7	-	6	-	4 6	-	4	-
	- - -	-	1½	-	1½	-	1	-	7/8	-	7/8
	- - -	-	1½	-	1½	-	1	-	7/8	-	7/8

PARTICULARS.	Materials.	700 Tons.		500 Tons.		300 Tons.		200 Tons.		150 Tons.	
		—	Diam ^r of Bolts.	—	Diam ^r of Bolts.	—	Diam ^r of Bolts.	—	Diam ^r of Bolts.	—	Diam ^r of Bolts.
		ft. in.	inches.	ft. in.	inches.	ft. in.	inches.	ft. in.	inches.	ft. in.	inches.
CRUTCHES: Abaft to secure the heels of											
the timbers - - - - - number	English oak	two	- -	two	- -	one	- -	one	- -	one.	- -
bolted - - - - - sided	- - -	- 10	- -	- 9	- -	- 8	- -	- 6½	- -	- 6	- -
with - - - - -	- - -	- -	1 ⅛	- -	1 ⅛	- -	1	- -	¾	- -	¾
WINDLASS: At the middle - diam ^r	{English oak or African}	1 7	- -	1 5	- -	1 3	- -	1 2	- -	1 1	- -
at the ends - - - - - ditto	- - -	1 5	- -	1 3	- -	1 1½	- -	1 1	- -	1 -	- -
pall bitt - - - - - square	ditto	1 3	- -	1 2	- -	1 1	- -	1 -	- -	- 10	- -
Carrick bitts - - - - - sided	ditto	- 7	- -	- 6	- -	- 5	- -	- 4½	- -	- 4	- -
moulded - - - - -	- - -	1 8	- -	1 6	- -	1 4	- -	1 4	- -	1 4	- -
CATHEADS: To be - - - sided	- - -	1 1	- -	1 -	- -	- 10	- -	- 7	- -	- 6	- -
moulded - - - - -	- - -	1 -	- -	- 11	- -	- 9	- -	- 6	- -	- 5	- -
ROTHER: The head to be made long enough to receive a yoke above the deck, and a tiller-hole above the yoke, to ship a spare tiller when necessary; to be well hooped; at the head athwartship -	- - -	1 2	- -	1 1	- -	1 -	- -	- 10	- -	- 9	- -
fore and aft - - - - -	- - -	1 4	- -	1 3	- -	1 2	- -	1 -	- -	- 11	- -
If with a round head, to be - diam ^r	- - -	1 3	- -	1 2	- -	1 1	- -	- 11	- -	- 10	- -
FORECASTLE and QUARTER-DECK: Beams											
sided	Baltic fir	- 6	- -	- 6	- -	- -	- -	- -	- -	- -	- -
moulded	- - -	- 5	- -	- 5	- -	- -	- -	- -	- -	- -	- -
clamp; one strake - - - thick	- - -	- 3	- -	- 3	- -	- -	- -	- -	- -	- -	- -
broad - - - - -	- - -	- 11	- -	- 11	- -	- -	- -	- -	- -	- -	- -
ENGINE ROOM: Bulkheads at each end of the engine room to be double of 1 ½ inch rabbeted deal on each side of a stantion, or to be solid fir (with a grove and tongue) - - - - - thick	Baltic fir	- 4½	- -	- 4½	- -	- 4	- -	- 4	- -	- 4	- -

I N D E X.

N.B.—The Figures following the Names of the Witnesses refer to the Questions in the Evidence; and where *App. p.* is prefixed, it refers to the page of the Appendix.

A.

ABERDEEN to Leith. A steam vessel running between, not seaworthy, *Hodges* 2074*, 2075.

Accident; How to relieve steamers in cases of, *Martin* 230. See also *Fire. Water.*

ACCIDENTS BY STEAM VESSELS:1. *Generally.*2. *By particular Vessels.*1. *Generally:*

By the Company's boats, *Beardmore* 77, 82—Number of, in a certain number of years, *Martin* 173-184—*Lucy* 392, 395—Occasioned by steamers to small craft, *Fisher* 496-500, *Honeyman* 670-684, *Brown* 921, 949-952, *Turnley* 1002-1007—How they may be remedied, *Fisher* 510, 586, 590—Comparative increase and decrease of, since steam navigation in use, *Lucy* 396-406, *Fisher* 600-616, *Honeyman* 690, 693, *Brown* 996-1001—Arise from racing, not from average speed, *Fisher* 566-568—From velocity of steamers more than competition of watermen, *Turnley* 1078-1083—By vessels being close together, *Turnley* 1086, 1087—From want of safety in the wherries, *Matthews* 1568-1571, 1573—Occasioned by the small size of the London wherries, *Fletcher* 1589-1602, 1637—And by the method of loading and overloading barges, *Fletcher* 1603-1608—And from not properly mooring ships, *Fletcher* 1609—Less liability of accidents from steam than sailing vessels, *Brown* 971-978—But more occur from improper rate of speed, *Brown* 979-981—Chance of, increased by the use of steam, *Fletcher* 1652-1655—Steamers cannot keep clear of, from their rate of speed, *Lucy* 418—Nor if speed reduced to a certain ratio, *Lucy* 419-423—Captains of steamers are without excuse in cases of, as the vessel will act which way they please, *Welbank* 640—Statement of an accident from four steamers racing, *Lucy* 339-350—By a steamer turning a wherry bottom upwards, *Lucy* 358-370—Swamping wherries a common occurrence, *Lucy* 372-374—From the swamping of loading craft, *Lucy* 375—From lighters rubbing each other, *Lucy* 385—From a sailing boat; might have been avoided if a steamer, *Lucy* 414-416—To a foreign vessel, from a steam-boat going over her: to what attributed, *Fisher* 515-519—Account of accidents that have happened to Trinity barges from steam vessels, *Honeyman* 642-659—Detailed statement of, *App. p.* 166—From sailing vessels would exceed those from steamers in same time, *Honeyman* 660, 166—Witness's boat swamped by a steam vessel, *Mitchell* 726-728—Situation of vessel, *Mitchell* 729—Cause of accident, *Mitchell* 734-737—From barges shipping water from the steamers, *Downey* 810, 811—In Limehouse Reach, by upsetting a wherry, *Walker* 816—Rate of speed of vessel, *Walker* 817—Relative situation of the boat and steam vessel, *Walker* 822-826, 838, 839—Number of passengers the boat was licensed for, *Walker* 831, 832—Manner of saving the passengers, *Walker* 834—The steam vessel was a Margate one, of a large size, *Walker* 837—Cause of accident, 840—To a passenger leaving a steam vessel, through want of care on the part of the steamer, *Brown* 922-925—To a boat by a collier, *Turnley* 1068—Method of preventing accidents in the Pool, *Hall* 462-464, *Hall*, Sir J. 2065, 2066—From what they arise, *Hall* 465, 466—Checking speed in the Pool would lessen the chance of, *Hall* 467, 468, *Brown* 983-988, *Turnley* 1084, *Morgan* 1100—How to effect it, *Morgan* 1101—Using a different description of boat to prevent accident would occasion loss to the owner of the present boats, *Fisher* 587-589—Distance steam vessels should be apart to prevent accidents, *Fisher* 569, 570, *Honeyman* 687, *Turnley* 1085—Summary power of recovering damages would be a great check to, *Richbell* 1221-1223.

2. *By particular Vessels; viz:*

Albion; to a lighter, *Lucy* 320-326, 329-338.

City of London; to a skiff, *Lucy* 281-320—To a ship's jolly-boat, *Brown* 857-921

—To a barge, *Brown* 953-970.

Eclipse; to a coal barge, *Green* 779-789.

Endeavour and Diamond; in Isleworth Reach, *Mitchell* 709-713.

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R E P O R T

FROM

SELECT COMMITTEE

ON

STEAM CARRIAGES;

WITH THE

MINUTES OF EVIDENCE

AND

A P P E N D I X.

*Ordered, by The House of Commons, to be Printed,
12 October 1831.*

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REPORT FROM SELECT COMMITTEE

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R E P O R T.

THE SELECT COMMITTEE appointed to inquire into, and to report upon, the proportion of Tolls which ought to be imposed upon Coaches and other Vehicles propelled by STEAM or GAS, upon Turnpike Roads; and also, to inquire into, and to report upon, the Rate of Toll actually levied upon such Coaches or other Vehicles under any Acts of Parliament now in force; and who were instructed to inquire generally into the present state and future prospects of Land Carriage by means of Wheeled Vehicles propelled by STEAM or GAS on common Roads; and to report upon the probable utility which the Public may derive therefrom; and who were empowered to report the MINUTES of the EVIDENCE taken before them, to the House:—HAVE examined the Matters referred to them, and agreed to the following REPORT.

THE Committee proceeded in the first instance to inquire how far the Science of propelling Carriages on common roads, by means of Steam or mechanical power, had been carried into practical operation; and whether the result of the experiments already made had been sufficiently favourable to justify their recommending to The House that protection should be extended to this mode of conveyance, should the Tolls imposed on Steam Carriages, by local Acts of Parliament, be found prohibitory or excessive.

In the progress of their inquiry, they have extended their examination to the following points on which the chief objections to this application of Steam have been founded; viz. the insecurity of Carriages so propelled, from the chance of explosion of the boiler, and the annoyance caused to travellers, on public roads, by the peculiar noise of the machinery, and by the escape of smoke and waste steam, which were supposed to be inseparable accompaniments.

It being also in charge to the Committee, "to report upon the proportion of "Tolls which should be imposed upon Steam Carriages," they have examined several proprietors of those already in use, as to the effect produced on the surface of roads by the action of the propelling wheels.

As this was too important a branch of their inquiry to rest entirely on the Evidence of individuals, whose personal interest might have biassed their opinions, the Committee also examined several very scientific Engineers, by whose observations on the causes of the ordinary wear of roads, they have been greatly assisted.

The Committee were directed also to report "on the probable utility which the "Public may derive from the use of Steam Carriages." On this point they have examined a Member of the Committee, well known for his intelligence and research on subjects connected with the interests of society, and they feel that they cannot fulfil this part of their instructions better than by merely referring The House to the Evidence of Colonel Torrens.

These inquiries have led the Committee to believe that the substitution of inanimate for animal power, in draught on common roads, is one of the most important improvements in the means of internal communication ever introduced. Its practicability they consider to have been fully established; its general adoption will take place more or less rapidly, in proportion as the attention of scientific men shall be drawn by public encouragement to further improvement.

Many circumstances, however, must retard the general introduction of Steam as a substitute for Horse Power on roads. One very formidable obstacle will arise from the prejudices which always beset a new invention, especially one which will at first appear detrimental to the interests of so many individuals. This difficulty can only be surmounted by a long course of successful, though probably unprofitable, experiment. The great expense of the Engines must retard the progress of such experiments. The projectors will, for a long period, work with caution, fearing not only the expense incurred by failure, but also that too sudden an exposure of their success would attract the attention of rivals. It is difficult to exemplify to The House how small and apparently unimportant an adaptation of the parts of the machinery, or of the mode of generating or applying the Steam, may be the cause of the most rapid success; yet he who by a long course of experiment shall have first reached this point, may be unable to conceal the improvement, and others will at once reap the benefit of it.

The Committee are convinced, that the real merits of this invention are such, that it may be safely left to contend with these and similar difficulties; there are others, however, from which the Legislature can alone relieve it. Tolls, to an amount which would utterly prohibit the introduction of Steam Carriages, have been imposed on some roads; on others, the Trustees have adopted modes of apportioning the charge which would be found, if not absolutely prohibitory, at least to place such Carriages in a very unfair position as compared with ordinary coaches.

Two causes may be assigned for the imposition of such excessive Tolls upon Steam Carriages. The first, a determination on the part of the Trustees, to obstruct, as much as possible, the use of Steam, as a propelling power; the second, and probably the more frequent, has been a misapprehension of their weight and effect on roads. Either cause appears to the Committee a sufficient justification for their recommending to The House, that legislative protection, should be extended to Steam Carriages, with the least possible delay.

It appears from the Evidence, that the first extensive trial of Steam as an agent in draught on common roads, was that by Mr. Gurney, in 1829, who travelled from London to Bath and back, in his Steam Carriage. He states, that although a part of the machinery which brings both the propelling wheels into action, when the full power of the Engine is required, was broken at the onset, yet that on his return he performed the last eighty-four miles, from Melksham to Cranford Bridge, in ten hours, including stoppages. Mr. Gurney has given to the Committee very full details of the form and power of his Engine, which will be found in the Evidence.

The Committee have also examined Messrs. Summers & Ogle, Mr. Hancock, and Mr. Stone, whose Steam Carriages have been in daily use, for some months past on common roads. It is very satisfactory to find that although the boilers of the several Engines described, vary most materially in form, yet that each has been found fully to answer the expectation of its inventor. So well, in fact, have their experiments succeeded, that in each case where the proprietors have ceased to use them, it has only been for the purpose of constructing more perfect Carriages, in order to engage more extensively in the business.

When we consider that these trials have been made under the most unfavourable circumstances,—at great expense,—in total uncertainty,—without any of those guides which experience has given to other branches of engineering;—that those engaged in making them are persons looking solely to their own interest, and not theorists,

theorists, attempting the perfection of ingenious models;—when we find them convinced, after long experience, that they are introducing such a mode of conveyance as shall tempt the Public, by its superior advantages, from the use of the admirable lines of Coaches which have been generally established;—it surely cannot be contended, that the introduction of Steam Carriages on common Roads is, as yet, an uncertain experiment, unworthy of legislative attention.

Besides the Carriages already described, Mr. Gurney has been informed, that from “twenty to forty others are being built by different persons, all of which have “been occasioned by his decided journey in 1829.”

The Committee have great pleasure in drawing the attention of The House to the Evidence of Mr. Farey. His opinions are the more valuable, from his uniting, in so great a degree, scientific knowledge to a practical acquaintance with the subject under consideration. He states, that he has “no doubt whatever but that a steady perseverance in such trials will lead to the general adoption of Steam Carriages:” and again, “that what has been done proves to his satisfaction the practicability of “impelling Stage Coaches (by Steam) on good common Roads, in tolerably level “parts of the country, without horses, at a speed of eight or ten miles per hour.”

Much, of course, must remain to be done in improving their efficiency; yet Mr. Gurney states, that he has kept up steadily the rate of twelve miles per hour; that “the extreme rate at which he has run is between twenty and thirty miles per “hour.”

Mr. Hancock “reckons, that with his Carriage he could keep up a speed of ten “miles per hour, without injury to the machine.”

Mr. Ogle states, “That his experimental Carriage went from London to South- “ampton, in some places, at a velocity of from thirty-two to thirty-five miles “per hour.”

“That they have ascended a hill rising one in six, at sixteen and a half miles “per hour, and four miles of the London road, at the rate of twenty-four miles and “a half per hour, loaded with people.”

“That his Engine is capable of carrying three tons weight, in addition to “its own.”

Mr. Summers adds, “That they have travelled in the Carriage at the rate of fifteen “miles per hour, with nineteen persons on the carriage, up a hill one in twelve.”

“That he has continued for four hours and a half to travel at the rate of thirty “miles per hour.”

“That he has found no difficulty of travelling over the worst and most hilly “roads.”

Mr. James Stone states, that “thirty-six persons have been carried on one “Steam Carriage.”

“That the Engine drew five times its own weight nearly, at the rate of from five “to six miles per hour, partly up an inclination.”

The several witnesses have estimated the probable saving of expense to the public, from the substitution of Steam power for that of Horses, at from one-half to two-thirds. Mr. Farey gives, as his opinion, “That Steam Coaches will very “soon, after their first establishment, be run for one-third of the cost of the present “Stage Coaches.”

Perhaps one of the principal advantages resulting from the use of Steam, will be, that it may be employed as cheaply at a quick as at a slow rate; “this “is one of the advantages over horse labour which becomes more and more “expensive, as the speed is increased. There is every reason to expect, that in the “end the rate of travelling by Steam will be much quicker than the utmost speed

“ of travelling by horses ; in short, the safety to travellers will become the limit to “ speed.” In horse draught the opposite result takes place ; “ in all cases horses “ lose power of draught in a much greater proportion than they gain speed, “ and hence the work they do becomes more expensive as they go quicker.” On this, and other points referred to in the Report, the Committee have great pleasure in drawing the attention of The House to the valuable Evidence of Mr. Davies Gilbert.

Without increase of cost, then, we shall obtain a power which will insure a rapidity of internal communication far beyond the utmost speed of horses in draught ; and although the performance of these Carriages may not have hitherto attained this point, when once it has been established, that at equal speed we can use Steam more cheaply in draught, than horses, we may fairly anticipate that every day's increased experience in the management of the Engines will induce greater skill, greater confidence, and greater speed.

The cheapness of the conveyance will probably be for some time a secondary consideration. If at present it can be used as cheaply as horse power, the competition with the former modes of conveyance will first take place as to speed. When once the superiority of Steam Carriages shall have been fully established, competition will induce economy in the cost of working them. The Evidence, however, of Mr. Macneil, showing the greater efficiency with diminished expenditure of fuel by Locomotive Engines on Railways, convinces the Committee, that experience will soon teach a better construction of the Engines, and a less costly mode of generating the requisite supply of Steam.

Nor are the advantages of Steam power confined to the greater velocity attained, or to its greater cheapness than horse draught. In the latter, danger is increased, in as large a proportion as expense, by greater speed. In Steam power, on the contrary, “ there “ is no danger of being run away with, and that of being overturned is greatly diminished. It is difficult to control four such horses as can draw a heavy carriage “ ten miles per hour, in case they are frightened, or choose to run away ; and for “ quick travelling they must be kept in that state of courage, that they are always “ inclined for running away, particularly down hills and at sharp turns of the road. “ In Steam, however, there is little corresponding danger, being perfectly controllable, “ and capable of exerting its power in reverse in going down hills.” Every Witness examined has given the fullest and most satisfactory evidence of the perfect control which the conductor has over the movement of the Carriage. With the slightest exertion it can be stopped or turned, under circumstances where horses would be totally unmanageable.

The Committee have throughout their Examinations been most anxious to ascertain whether the apprehension, very commonly entertained, that an extensive use of these Carriages on roads would be the cause of frequent accidents and continued annoyance to the Public, were well founded.

The danger arising from the use of Steam Carriages, was stated to be twofold ;—that to which passengers are exposed from explosion of the boiler, and the breaking of the machinery, and the effect produced on horses, by the noise and appearance of the Engine.

Steam has been applied as a power in draught in two ways ; in the one, both passengers and Engine are placed on the same Carriage ; in the other, the Engine Carriage is merely used to draw the Carriage in which the load is conveyed. In either case, the probability of danger from explosion has been rendered infinitely small, from the judicious construction of boiler which has been adopted.

These boilers expose a very considerable surface to the fire, and Steam is generated with the greatest rapidity. From their peculiar form, the requisite supply of Steam depends on its continued and rapid formation ; no large and dangerous quantity

quantity can at any time be collected. Should the safety valve be stopped, and the supply of Steam be kept up in greater abundance than the Engines require, explosion may take place, but the danger would be comparatively trifling, from the small quantity of Steam which could act on any one portion of the boilers. As an Engine, invented by Mr. Trevithick, has not been as yet applied to Carriages, the Committee can do no more than draw the attention of The House to the ingenuity of its contrivance. Should it in practice be found to answer his expectation, it will remove entirely all danger from explosion. In each of the Carriages described to the Committee, the boilers have been proved to a considerably greater pressure than they can ever have to sustain.

Mr. Farey considers that "the danger of explosion is less than the danger attendant on the use of horses in draught; that the danger in these boilers is less than in those employed on the Railway, although there even the instances of explosion have been very rare." The danger arising to passengers from the breaking of the machinery need scarcely be taken into consideration. It is a mere question of delay, and can scarcely exceed in frequency the casualties which may occur with horses.

It has been frequently urged against these Carriages, that, wherever they shall be introduced, they must effectually prevent all other travelling on the road; as no horse will bear quietly the noise and smoke of the Engine.

The Committee believe that these statements are unfounded. Whatever noise may be complained of, arises from the present defective construction of the machinery, and will be corrected as the makers of such Carriages gain greater experience. Admitting even that the present Engines do work with some noise, the effect on horses has been greatly exaggerated. All the Witnesses accustomed to travel in these Carriages, even on the crowded roads adjacent to the Metropolis, have stated, that horses are very seldom frightened in passing. Mr. Farey and Mr. Macneil have given even more favourable Evidence, in respect to the little annoyance they create.

No smoke need arise from such Engines. Coke is usually burned in Locomotive Engines, on Railways, to obviate this annoyance; and those Steam Carriages which have been hitherto established also burn it. Their liability to be indicted as nuisances will sufficiently check their using any offensive fuel.

There is no reason to fear that waste Steam will cause much annoyance. In Mr. Hancock's Engine it passes into the fire, and in other Locomotive Engines it is used in aid of the power, by creating a quicker draught and more rapid combustion of the fuel. In Mr. Trevithick's Engine it will be returned into the boiler.

The Committee, not having received evidence that gas has been practically employed in propelling Carriages on common roads, have not considered it expedient to inquire as to the progress made by several very scientific persons who are engaged in making experiments on gases, with the view of procuring a still cheaper and more efficient power than Steam.

The Committee having satisfied themselves that Steam has been successfully adopted as a substitute for Horse Power on roads, proceeded to examine whether Tolls have been imposed on Carriages, thus propelled, so excessive as to require legislative interference, and also to consider the rate of Tolls by which Steam Carriages should be brought to contribute in fair proportion, with other Carriages, to the maintenance of the roads on which they may be used.

They have annexed a List of those Local Acts, in which Tolls have been placed on Steam, or mechanically propelled Carriages.

Mr. Gurney has given the following specimens of the oppressive Rates of Tolls adopted in several of these Acts: On the Liverpool and Prescot road, Mr. Gurney's Carriage would be charged £. 2. 8 s., while a loaded Stage Coach would pay only 4s.

On the Bathgate road the same Carriage would be charged £.1. 7s. 1d., while a coach drawn by four horses would pay 5s. On the Ashburnham and Totness road Mr. Gurney would have to pay £.2., while a coach drawn by four horses would be charged only 3s. On the Teignmouth and Dawlish roads the proportion is 12s. to 2s.

Such exorbitant Tolls on Steam Carriages can only be justified on the following grounds.

First, because the number of passengers conveyed on, or by, a Steam Carriage will be so great as to diminish (at least to the extent of the difference of the rate of Toll) the total number of Carriages used on the road; or, secondly, because Steam Carriages induce additional expense in the repairs of the road.

The Committee see no reason to suppose that, for the present, the substitution of Steam Carriages, conveying a greater number of persons than common coaches, will take place to any very material extent; and as to the second cause of increased charge, the Trustees, in framing their Tolls, have probably not minutely calculated the amount of injury to roads likely to arise from them.

The Committee are of opinion that the only ground on which a fair claim to Toll can be made, on any public road, is to raise a fund, which, with the strictest economy, shall be just sufficient, first, to repay the expense of its original formation; secondly, to maintain it in good and sufficient repair.

Although the Committee anticipate that the time is not far distant when, in framing a scheme of Toll for Steam Carriages, their general adoption, and the great number of passengers which will be conveyed on a small number of vehicles, will render it necessary not only to consider the amount of injury actually done to the road, but also the amount of debt which may have been incurred for its formation or maintenance; yet at present they feel justified by the limited number of such Carriages, and by the great difficulties they will have to encounter, in recommending to The House, that in adopting a system of Toll, the proportion of "wear and tear" of roads by Steam, as compared with other Carriages, should alone be taken into consideration.

Unless an experiment were instituted on two roads, the one reserved solely for the use of Steam Coaches, the other for Carriages drawn by horses, for the purpose of ascertaining accurately the relative wear of each, it would be quite impossible to fix with certainty the proportion of Tolls to which, on the same road, each class of vehicles should be liable. To approximate, however, as nearly as possible to the standard of relative wear, the Committee have compared the weights of Steam Carriages with those of loaded Vans and Stage Coaches. They have tried to ascertain the causes of the wear of roads; also the proportion of injury done by the feet of horses, and the wheels of coaches; how far that injury is increased by increased velocity, and also in what degree the wear of roads by loaded Carriages may be decreased by any particular form of wheel.

The Committee would direct the attention of The House especially to the Evidence of Mr. Macneil, whose observations on this branch of the subject, being founded on a long course of very accurate experiments, are peculiarly interesting and useful. He estimates that the feet of horses drawing a fast Coach, are more injurious to the road than the wheels, in the proportion of three to one nearly; that this proportion will increase with the velocity; that by increasing the breadth of the tires of the wheels, the injury done to roads by great weights may be counteracted. He considers that on a good road, one ton may be safely carried on each inch of width of tire of the wheels.

Mr. M'Adam and Mr. Telford have given corresponding Evidence as to the greater wear caused by horses' feet than by wheels of Carriages.

Each of the above Witnesses agrees, that, adding the weight of the horses to that of the Coach, and comparing the injury done to a road by a Steam Carriage of a weight equal

equal to that of the Coach and horses (the wheels being of a proper width of tire), the deterioration of the road will be much less by the Steam Carriage than by the Coach and horses.

As to the injury to roads, which is anticipated from the "slipping" of the wheels, it may safely be left to the proprietors to correct: the action of the wheel slipping involves a waste of power and an useless expenditure of fuel, which, for their own sakes, they will avoid.

Apprehension has also been entertained, that although the peculiar action of the wheels may not be injurious, yet that, from the great power which may be applied, if the Steam were worked at very high pressure, or if the size of the Engine were increased, greater weight might be carried than the strength of the road could bear.

Undoubtedly, in proportion to the advance of the science, will be the increase of weight drawn by an Engine with a given expenditure of fuel; but there are many practical difficulties to be surmounted before the weight so drawn can reach the point when it would be destructive of roads. There are no theoretical reasons against the extension of the size of the Engines. The difficulties, according to Mr. Gurney, are of a practical nature, and only in the "difficulty of management of a large Engine." In proportion as we augment the power of the Engines, we must increase their strength, and consequently their weight; the greater weight will be a material diminution of their efficiency. To a certain extent the power may be increased in a greater ratio than the weight; but, with our limited knowledge of the application of Steam, and with the present formation of the Public Roads, the point will be very soon attained, when the advantage of increased power will be counterbalanced by the difficulties attendant on the increased weight of the engines.

The weight of the Steam Carriages at present in use varies from 53 to 80 cwt.; but it must be recollected that they are mere models; they were made with attention to strength only, to bear the uncertain strain to which they would be exposed in the course of experiments, and a very considerable diminution of weight may be anticipated.

The weight drawn, at the rate of ten miles per hour, by Mr. Gurney's Engine, has not, on any extent of road, exceeded the weight of the drawing Carriage; nor is it likely, with the difficulties to be encountered on the present lines of road, from their quality and the numerous ascents, that the weight drawn will be in excess of the strength of the roads. The immense quantity of spare power required to surmount the different degrees of resistance likely to occur, would render the Engine too unmanageable. This will appear evident from the force of traction required to draw a Waggon over the Holyhead and Shrewsbury road, which varied from 40 to upwards of 300 lbs.

In considering the effect on roads, we must not overlook one peculiarity, in which they have a great advantage over other Carriages. In Coaches drawn by horses, the power being without the machine to be moved, it becomes an object of the greatest importance to give as much effect as possible to the power, by diminishing the resistance, arising from the friction of the wheels upon the surface of the road. For this purpose, the proprietors of Coaches and Waggon have adopted every possible contrivance, so to reduce the tires of their wheels, that a very small portion of them may press on the road; in some Coaches they are made circular in their cross section, so that the entire weight of the Carriage presses on a mere point; should the materials be soft, such wheels cut their way into the road like a sharp instrument. The owners of Waggon too have adopted a similar plan. Mr. Macneil states that the actual bearing part of the tire of apparently broad-wheel Waggon, is reduced to three inches, by the contrivance of one band of the tire projecting beyond the others.

With Steam, on the contrary, a certain amount of adhesion to the roads is required to give effect to the action of the machinery, or the wheels would slip round, and make no progress. It appears of little importance therefore, so far as relates to the Engine, whether the requisite amount of friction be spread over a broad surface of

tire, or be concentrated to a small point; but as the wheels, by being too narrow, would have a tendency to bury themselves in every soft or newly made road, and thus raise a perpetual resistance to their own progress, it actually becomes an advantage to adopt that form, which is least injurious to the road. The proprietors, who have been examined on this point, seem to be quite indifferent as to the breadth of tire they may be required to use.

These considerations have convinced the Committee, that the Tolls enforced on Steam Carriages have, in general, far exceeded the rate which their injuriousness to roads, in comparison with other Carriages, would warrant; they have found, however, considerable difficulty in framing a scale of Tolls applicable to all roads, in lieu of those authorized by several local Acts.

With this view, they have carefully examined the various modes of imposing Toll, either suggested by the Witnesses, or already adopted.

They are as follows:

1. To place a Toll proportioned to the weight of the Carriage and load;
2. On the number of Passengers;
3. On the horse-power of the Engine;
4. On the number of Wheels;
5. An unvarying Toll.

Each of these plans seems liable to serious objections, which the Committee beg to submit to The House.

No plan of Toll has been more frequently recommended than that of a charge in proportion to the weight of the Engine and load. As this is the most plausible, and (if it could be levied without other disadvantages) would probably be the fairest standard, the Committee have considered it right to state, at some length, their reasons for not recommending its adoption.

If weight be taken as the standard, the Toll must be a fixed charge, either upon the weight of the Engine and Carriage, without reference to the load; or, upon an estimated average of the load carried; or, a fluctuating charge according to the weight, at the several periods of a journey.

The first would be at least free from the uncertainty of the other two, and therefore, would be preferable; but what scale of charge per cwt. could the Committee recommend as applicable to all roads? Their Toll should vary according to every different rate of charge on Carriages; besides, it would appear to the Trustees very unjust to exclude the consideration of that which would be deemed the most material cause of the wear of their roads; viz. the load.

A fluctuating charge on weight would be most injurious to a Carriage, which will mainly depend for success on its speed; constant altercations would take place between the toll collectors and proprietors; a minute calculation would be required at every turnpike gate; in fact, unless an accountant were placed at each, the Committee cannot conceive how the proportions could be satisfactorily arranged, nor would there be any desire on the part of the toll collector to shorten the delay occasioned by these interruptions.

Mr. Gurney has delivered in a scale of Tolls, graduated according to weight and width of tire of the wheel. As this has been drawn up by a person interested in the success of Steam Carriages, it might have been expected to be more favourable to them. The Committee, however, have not adopted it, because of the difficulties and interruptions, which a fluctuating rate of Toll would induce; besides, this scale purports to be intended for a road, where 3*d.* is charged for a horse drawing, and 1*d.* for a horse not drawing; the scale would be inapplicable therefore when the charge was 2*d.* and 1*d.*, 3*d.* and 1½*d.*, 4*d.* and 1*d.*, 4*d.* and 1½*d.*, 8*d.* and so on. Again, what standard of weight, in relation to horse Coaches, could be adopted?

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The average weight of loaded Coaches differs very much on different roads. It has been suggested, that a loaded Coach, including the weight of four horses, would weigh on an average four tons; and that if 6*d.* per horse were chargeable to the Coach, 6*d.* per ton should be placed on a Steam Carriage; this would be unjust, as Vans, which frequently weigh upwards of six tons, would only pay 2*s.*, and a Steam Carriage would pay 3*s.* Even if the injury done to the road by each were equal, this would be an unfair Toll; but it will appear more evidently unjust if the greater proportionate injury done by the feet of horses drawing, than by the propelling wheels, be taken into consideration.

The object of every Steam Coach proprietor will be to attain the greatest possible lightness of Machinery and Engine; because thereby he renders his power more efficient for the draught of the remunerating load. To place the Toll on the weight of the Engine would tend to induce him to decrease the strength of his boiler and machinery to an extent which might be dangerous to the passengers, and very detrimental to the success of Steam travelling, as the Public will easily be led to believe, that accidents really occurring from injudicious legislation, were inseparable from the adoption of this power as an agent in propelling Carriages.

The only fair plea for charging Tolls on such Carriages, in proportion to their weight, is to prevent a load being propelled or carried which would permanently injure the road; within this limit it would be as injudicious to interfere with their progressive efficiency, (which can only result from improvements of the Machinery and the system of generating and applying Steam) as it would be to tax Carriages drawn by large and well-bred horses, more heavily than such as were drawn by horses in worse condition and of smaller size and power.

The roads at present have to sustain Waggon, weighing at times, with their horses, nearly ten tons; it is in evidence, that the breadth of wheels required by various Acts of Parliament, is so easily evaded, that it affords no protection to the road; there appears to the Committee no fair reason to suppose, that Steam Carriages, approaching even to this weight, will be used on any turnpike road, at least for a very considerable period, during which the increase of weight will be gradual, and will give ample warning to the Legislature when it should interfere.

To charge a Toll according to the number of passengers conveyed, is scarcely less objectionable. If a fluctuating Toll be intended, it would be as inadmissible as to propose a similar mode of charging for fast Coaches, and would be open to all the cavil and interruptions to which a fluctuating Toll on weight would be liable. If the Toll were fixed according to the number of passengers the Carriage were capable of conveying, it would imply the necessity of a license, limiting the number of passengers, and cramping the progress of improvement of a machine, the capabilities of which can only be ascertained slowly and by continued experiment.

It must be also recollected, that these Carriages will probably have to travel for a long period without passengers, until by their punctuality and safety they shall have induced the Public to venture in them. Nor is this probability weakened by the immense number of passengers who commenced using the Locomotive Carriages on the Manchester and Liverpool Railway, immediately after their introduction: these Engines were established among a population accustomed to Machinery and Steam, and therefore not entertaining the same apprehensions of its danger which will require to be surmounted elsewhere.

The Trustees of the Liverpool and Prescot road have already obtained the sanction of the Legislature to charge the monstrous Toll of 1*s.* 6*d.* per "horse-power," as if it were a national object to prevent the possibility of such Engines being used. Besides, they have supplied no standard of their own conception of horse-power. Engineers have differed very much in their estimates of this power, there is not, therefore, much probability that the opposite interests of a Steam Coach proprietor and Toll collector would lead to any agreement as to the meaning of the term. But suppose the Legislature were to settle this point, and to arrange that a certain length of stroke and diameter of cylinder should represent a certain power, we still fail to

ascertain that which alone it is essential to know; viz. the actual efficiency of the Engine. Can we regulate the density of Steam at which an Engine of a given size should be worked? To be effectual, it would be also necessary to ascertain the quantity of water consumed, and even this check would be inadequate with an Engine on Mr. Trevithick's principle. If the Toll be left as at present on "horse-power," it would be the obvious interest of the proprietor to work with the smallest nominal power, but to increase as much as possible the force of his Steam, thereby increasing the probability of explosion.

Some Trustees have placed the Toll upon the number of wheels. The Committee would object to this mode of charge, if only, because it interferes between the rival modes of Steam travelling, and gives a bounty in favour of that, in which the Engine is placed on the same Carriage with the passengers. The opposite plan of separating the Engine from the Carriage is that which probably the Public will prefer, until the safety of the mode of conveyance shall have been fully ascertained.

There is still a more serious objection to this mode of charge, it tends to discourage the use of separate Carriages; although it must be evident, that if a certain weight be carried, it will be much less injurious to the road when divided over eight wheels, than when carried on four only. On this point the Committee must again refer to Mr. Macneil's Evidence. They cannot, therefore, recommend The House to adopt a scale of Toll which shall increase in inverse proportion to the injury done to the road. It will be seen in Mr. M'Adam's Evidence, that the Toll on Steam Coaches imposed by the Metropolitan Roads Act, is liable to this objection.

Some of the local Acts have placed an unvarying Toll on Steam Carriages. This, if moderate, would be unobjectionable; but the Committee could not propose any sum which would adapt itself to the necessary varieties of expense in keeping up different roads, by which the Tolls on common Carriages have been regulated. A fixed Toll has, too, this disadvantage, that light experimental Carriages, or such as are built solely for speed, would be liable to the same Toll, as Steam Carriages heavily laden.

The Committee feel that, however strong their conviction may be of the comparatively small injury, which properly constructed Steam Carriages will do to the roads, yet this conviction is founded more on theory, and perhaps what may be considered as interested evidence, than practical experience; they would therefore recommend, that The House should not make, at present, any permanent regulations in favour of Steam. The experience which will be gained in a very few years, will enable the Legislature to form a more correct judgment of the effect of Steam Carriages on roads, than can be now made. They therefore recommend that the *Tolls* imposed on Steam Carriages by local Acts, where they shall be unfavourable to Steam, shall be suspended during *three years*; and that, in lieu thereof, the Trustees shall be permitted to charge Toll according to the rate to which the Committee have agreed.

The House will have perceived, in the former part of this Report, that there are two modes of applying Steam in lieu of horses in draught; one, where the Engine and passengers are on the same Carriage, the other where the Engine is placed on separate wheels, and is merely used to propel or draw the Carriage. Although the difference of weight may be in favour of the former mode, yet, as on the latter it is divided over eight wheels, instead of four, its small excess cannot justify a larger Toll being imposed, as it will be found much less injurious to the roads. The Committee therefore recommend, that in charging Toll, the Engine Carriage and Carriage drawn shall be considered but as one.

As it is the opinion of all the engineers examined, that the use of narrow wheels has been the great cause of the wear of roads, and that cylindrical wheels, of a certain width of tire, are not only the least injurious, but that, in some states of the road, they may be even beneficial, the Committee recommend, that the wheels of the Engine Carriage should be required to be cylindrical, and of not less than $3\frac{1}{2}$ inches width of tire. No proprietor of Steam Carriages has expressed the slightest

fear of any inconvenience or loss from the use of such wheels. Beyond this, the Committee would not recommend interference with the breadth of tire, or form of wheels; it should be left to the proprietors freely to select the breadth of tire they shall find most convenient, in proportion to the weight carried.

The Committee have divided Steam Carriages (intended for passengers) into two classes, to be subject to different rates of Toll. The first, where the Carriage is not plying for hire, or where, if plying for hire, it shall not be calculated for, or carry at any time, more than six passengers; the original cost of such machines, and the expense of working them, will sufficiently protect the roads from any great number of merely experimental Carriages; and for the same reason they will not be of a weight or size likely to be injurious. A Steam Carriage only calculated to convey six passengers will be solely used where great speed is required, and will be so light as to cause very little wear of the road, probably much less than many Carriages drawn by the number of horses which the Committee recommend as the standard of charge for this class. The Toll, therefore, proposed to be placed on this class of Steam Carriages is that, which (on the several roads, where they may be used) is charged on a Carriage drawn by two horses.

In the second class they have placed all other Steam Carriages, except those travelling at slow rates, for goods only; Carriages of this class should pay the same Toll as may be charged on a coach drawn by four horses. This may at first appear unjust from the supposed power of Steam to draw almost unlimited weight. The Committee have already enumerated the difficulties hitherto encountered in attempting to propel very heavy loads on turnpike roads. They are such as to discourage the expectation, that, within any short period of time, the system will have been so perfected as to give rise to inconvenience from this source; should any hereafter be found, it will then be sufficient to remedy the defect. Until a due proportion of the parts of the machinery shall have been ascertained, the makers of these Carriages will vary but cautiously, from the models at present in use; their object will be, for some time, the perfecting of them, rather than the uncertain experiment of increasing their size.

The Committee do not anticipate, that, for a considerable period, Steam will be used as a propelling power on common roads for heavy Waggon. It appears to have been the general opinion of the Witnesses, that in proportion as the velocity of travelling by Steam on common roads is diminished, the advantages of Steam over horse power are lost. The efficiency of horses in draught is rapidly diminished as their speed is increased; while, on the contrary, the weight, which could be carried or propelled, at any great velocity, by Steam, could not be more cheaply conveyed, were the speed decreased to that of the slowest waggon.

As speed, therefore, is the cause of greatly increased expense where horses are used, while with Steam it is comparatively unimportant, it is probable that the latter will be chiefly resorted to when rapidity of conveyance is required. Mr. Gurney considers, that under four miles per hour, horses can be used in draught more economically than Steam. Should it, however, be deemed profitable to convey heavy goods by Steam Carriages, the Committee recommend that there should be as little interference as possible with the number of carts employed; as the effect on the surface of roads would be infinitely more injurious if heavy loads were placed on a single cart, than if the same weight were divided over several. The Committee recommend, that where Carriages, containing heavy goods alone, are propelled by Steam, the weight of the load should be charged, without reference to the number of carts on which it may be carried.

As a horse is able to draw from 20 to 40 cwt. on common roads, they propose that each 20 cwt. of load conveyed in, or drawn by, a Steam Carriage, should be chargeable at the same rate of Toll as one horse drawing a cart.

A charge on weight is not so objectionable where goods are conveyed at a slow rate, as when speed is alone required.

In conclusion, the Committee submit the following Summary of the Evidence, given by the several Witnesses, as to the progress made in the application of Steam to the purposes of draught on common roads.

Sufficient Evidence has been adduced to convince Your Committee,—

- 1.—THAT Carriages can be propelled by Steam on common roads at an average rate of ten miles per hour.
- 2.—THAT at this rate they have conveyed upwards of fourteen Passengers.
- 3.—THAT their weight, including Engine, fuel, water and attendants may be under three tons.
- 4.—THAT they can ascend and descend hills of considerable inclination with facility and safety.
- 5.—THAT they are perfectly safe for Passengers.
- 6.—THAT they are not (or need not be, if properly constructed) nuisances to the Public.
- 7.—THAT they will become a speedier and cheaper mode of conveyance than Carriages drawn by horses.
- 8.—THAT, as they admit of greater breadth of tire than other Carriages, and as the roads are not acted on so injuriously as by the feet of horses in common draught, such Carriages will cause less wear of roads than coaches drawn by horses.
- 9.—THAT rates of Toll have been imposed on Steam Carriages, which would prohibit their being used on several lines of road, were such charges permitted to remain unaltered.

The Committee do not anticipate, that for a considerable period, Steam will be used as a propelling power on common roads for heavy Waggonage. It appears to have been the general opinion of the Witnesses, that in proportion as the velocity of travelling by Steam on common roads is diminished, the advantages of Steam over horse power are lost. The efficiency of horses in draught is rapidly diminished as their speed is increased; while, on the contrary, the weight, which could be carried or propelled, at any great velocity, by Steam, could not be more rapidly conveyed were the speed decreased to that of the slowest waggon.

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As a horse is able to draw from 20 to 40 cwt. on common roads, they propose that each 20 cwt. of load conveyed in, or drawn by, a Steam Carriage should be chargeable at the same rate of Toll as one horse drawing a cart.

A charge on weight is not so objectionable where goods are conveyed at a slow rate, as when speed is alone required.

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In evidence, the Committee report the following account of the evidence given by the witnesses in the progress made in the application of steam to the purpose of transport on common roads.

1.—That the evidence has been reduced to a common basis, and that the evidence is as follows:—

2.—That in the early days of the steam carriage, the evidence was given by the witnesses in the progress made in the application of steam to the purpose of transport on common roads, and that the evidence is as follows:—

3.—That the evidence has been reduced to a common basis, and that the evidence is as follows:—

4.—That the evidence has been reduced to a common basis, and that the evidence is as follows:—

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Mercurii, 3^o die Augusti, 1831.

CHARLES D. O. JEPHSON, ESQUIRE,

IN THE CHAIR.

Mr. Goldsworthy Gurney, called in; and Examined.

ARE you the proprietor of a Steam Carriage used on public roads?—Not the proprietor; I am the patentee.

On what roads have you commenced running such Carriages?—I have commenced on several roads. The first road I commenced was Edgware, then Stanmore; I ran there for a short time only, principally experimentally; then to Barnet, to Edgware, to Finchley, and other places. I also ran a Carriage on my own account to Bath and back; that was only one journey—an experimental journey. Since that they have been running as public stages, principally between Gloucester and Cheltenham.

For what period?—Since February last. They were stopped about three weeks, in consequence of an accident to one of the axle-trees; they were to begin again about this time.

Have you been yourself on these Carriages while they have been running?—Yes; in the first instance, I almost always accompanied the Carriage.

State in detail the progress which you have made in bringing these Carriages to their present improved state?—I must beg to have reference to the drawings. [*The Witness produced the drawings, Nos. 1, 2, 3, 4, 5 and 6.*] This first drawing, No. 1, was the first experiment I made connected with the subject, in which I conceived I had removed the difficulty of driving Steam Carriages on common roads, by inventing a light and powerful boiler, of which this is a representation. The application of that boiler will be seen in No. 2. The boiler itself is not represented on the Carriage in this drawing, but simply the engine, and the modes of propelling the Carriage. This was in the year 1825. It was then a very prevalent opinion that the bite or friction of the power to the ground was not sufficient to propel the Carriage along a common road, particularly up hill; it was thought that the wheel would turn round, and the Carriage not proceed. With that view, the apparatus shown in this figure, No. 2, which I call feet or propellers, were proposed to be used; the mode of action I presume will be seen from the drawing. I soon found by experience, in numerous experiments not connected with the drawing, that the propellers were rarely or never wanted; and I then applied the power immediately to the two hind wheels, through a crank, in the common mode of a steam-boat, the propellers being also fixed, but travelling slower than the wheels, were brought into action if the wheels slipped, which it was thought would be the case in difficult situations. This Carriage went up Highgate Hill in 1826, and to Edgware, also to Stanmore, and went up Stanmore Hill, and Brockley Hill, near Stanmore, and against all those hills the wheels never turned, and the legs never came into action. This is No. 3. After these experiments, the legs or propellers were entirely removed, and from further experiment it was found, by a peculiar application of the steam, (namely, by "wiredrawing,") that the bite of one of the hind wheels was sufficient for all common purposes. If the steam was let on suddenly, the wheel would turn round, and the Carriage not go forward; but when wire-drawn, one wheel was found sufficient. By this arrangement, also, the Carriage was guided more accurately and more easily. The second wheel was applied by uniting it with the crank at any time, if one was found insufficient.

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In general, were the wheels connected together, or had they an independent motion?—Always one was attached to the axle; they had no independent motion; this will be seen by reference to No. 5 on the arm or carrier of the wheel (which is a part of the axle), and can be attached to the wheel at pleasure by a bolt, making the wheel also in that case part of the axle; this Carriage, I should observe, ran to Barnet, and went up all the hills to Barnet, in 1827, with one wheel only attached to the axle, and was run for about eighteen months experimentally in the neighbourhood of London; from these experiments showing that one wheel was sufficient to propel the Carriage, and the Carriage being at the same time reduced two-thirds in weight, it was thought desirable to draw another Carriage, instead of to carry on the same; that will be seen in No. 5. This Carriage went to Bath, and over all the hills between Cranford Bridge and Bath, and returned with only one wheel attached to the axle; the other carrier by means of attachment having broken in the first onset, and not having been repaired until after its return; the Carriage was also injured slightly at Melksham, in consequence of a riot there; we waited about two days at Bath to get this injury repaired, and returned from Melksham to Cranford Bridge in ten hours, a distance of eighty-four miles, including stoppages. I have come now almost to the practical application of it; this is a drawing of the Carriages we are now building (No. 6.)

Have you made any alteration in the formation of the boilers since 1825?—We have altered and changed in the mechanism only; the principle has been invariably adhered to; the present Carriage is deprived of its chimney and a variety of other disagreeables about the Carriage.

Has your principle with respect to all remained the same?—Precisely the same.

How far have you improved the formation of your working Carriage as to weight?—The weight was a principal objection to the practical application of the Carriage; the first Carriage of a given power weighed four tons; this was objectionable on account of its weight, which was severely felt in consequence of its effect on the roads. I thought it would injure the roads, which injury would produce a toll that would perhaps injure the economy of it: No. 3, weighed four tons; No. 4, weighed three tons, with the same power; No. 5, two tons, with the same power; the present Carriages building will not weigh more than 35 cwt. with the same power.

What does the Carriage which runs between Gloucester and Cheltenham weigh?—By a letter from a Magistrate, now produced, it is stated to weigh nearly three tons; it ought to weigh only 45 cwt.; if it weighs three tons, there is extra weight, of which I know nothing; this which I produce a sketch of, marked No. 6, weighs 35 cwt. and it has the same power. Those Carriages at Gloucester were built principally under the superintendence of another person.

When you state the weight of 35 cwt. you mean the weight of the travelling Carriage alone, without the weight of the passengers, or the weight of fuel or water?—Yes, just so; I think it is possible to reduce the weight considerably as improvements go on; I have a Carriage now building which I do not expect will weigh above five cwt., which I expected to do the work of about one horse, and carry two or three people; speed is a particular object, and it is not intended to carry any thing more than light parcels.

Into what stages would you divide your journies most conveniently?—I think about seven miles.

What weight of fuel and water would you lay in for such a stage?—The fuel and water will be in proportion to the size and power of the Carriage.

For a machine, weighing 35 cwt. marked by you No. 6, what weight of fuel and water would you require?—Three bushels and a half of coke is the quantity we take to supply this distance, and the first charge two bushels; the first charge always remaining, it decreases of course down to the first charge, and taking the mean it will be $3\frac{1}{2}$. The weight of water at present I think is about 10 gallons a mile which is consumed, that would be 70 gallons, a gallon weighing about 10 lbs. making 700 lbs., the mean of this will give the quantity. If the roads are good it does not take so much, we can do with almost half the quantity; if the roads are bad we must take the whole quantity, and the mean will be 350 lbs.

Will you state the progressive alterations you have made in the diameter of your wheel, and the breadth of the tire?—The diameter of the wheel has generally been the same, about five feet.

What difference is there between the fore and hind wheels?—About a foot in diameter difference; about the proportion of an ordinary carriage.

The power is attached to the hind wheels?—To the hind wheels only.

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Do the wheels follow in the same track?—That is a matter of option.

The Committee understand that they do not in that which travels between Cheltenham and Gloucester?—Perhaps that is the case there; it is a matter of convenience in some experiments; I have built them with three wheels only, one wheel in front, and in some, as in No. 3, with six wheels, my present Carriage has only four.

Do the hind wheels of your present Carriage follow in the same track with the fore wheels?—Yes; those Carriages now building will do so; the hind wheels will be nearer to each other than in many others.

What diameter do you propose to make the propelling wheels of your new Carriages?—I propose to have them about five feet; I would observe, that by taking a wheel of five feet diameter off the axle, and putting on one of two feet six, the engine would be multiplied double in its power, and lose of course one half in speed; in some cases it may be desirable to do so if the Carriages are used for general purposes; for speed and dragging of heavy weights alternately, larger or smaller wheels may be put to meet circumstances as they occur.

From the experiments you have made, with a view to proportion the diameter of the wheels with the weight to be drawn and the velocity required, what diameter of propelling wheel do you think will be generally used?—Five feet; the piston of the engine should not travel more than two miles and a half per hour; therefore we may multiply from this rate to any speed we please.

What is the breadth of the tire of your present wheel?—None less than two inches; but in late experiments we found a wide tire more desirable than a narrow one, and we have increased it to about three inches and a half in width; we found that there is no increase of power necessary with a wide wheel, but I think on the contrary rather less; we have not been able to decide positively the true variation in power, but the difference is so slight, that it is not perceptible.

What is the ordinary width of the tire of wheels of coaches?—I think about two inches; in a private carriage rather under two, and in stage coaches over two inches.

Of how many horse-power is your ordinary travelling Engine?—Twelve nominal Steam-engine horse-power; to work eight hours it takes the common stage coach 32 horses; an Engine propelling the same weight for eight hours should be considered a 32 horse-power, according to the rule laid down by Engineers, but this is not true as to locomotive Engines.

Taking your latest improvement, to what number of draught horses would it be equivalent?—I think about 10 cwt. will do the work of a horse on the road; 35 cwt. will be about $3\frac{1}{2}$ horses' work always.

You mean that it will displace about three horses and a half at a time on the road?—Yes, in each stage it will displace $3\frac{1}{2}$ or 4 horses, and about 30 horses in the eight hours.

Is that in practice, or in idea?—Practice.

Is the chief weight supported on springs?—The whole is on springs.

What is the weight of an ordinary stage-coach?—About 24 cwt.; I think from 18 to 24.

How many persons will that take?—I think about 18.

What would be the weight of your Engine Carriage sufficiently powerful to draw a Carriage containing 18 persons?—The weight of the propelling Carriage would be about the weight of four horses; the weight of the Carriage drawn would be precisely that of a Carriage drawn by horses, and I find the weight of a horse to average about 10 cwt.; therefore, taking four horses at 10 cwt., the four horses would be two tons, which is somewhere about the weight of my Carriage; to do the same work, some horses weigh as much as 16 cwt. some considerably less than 10 cwt.

Have you examined the effect on the roads of the propelling wheels of your Carriage?—As far as I am enabled to judge, I should say that they did no more injury than any other Carriage of the same weight; I mean the Carriage itself, weight for weight. I have taken the loss of iron from the tires of the wheels, and compared it with that of the loss from other Carriages running the same number of miles, and I found the loss the same nearly.

Do you find that the wheel never slides in the turn?—If it does, it is either imperfect or the fault of the engineer; if the steam is wire-drawn (using the technical term) it never does so; if the steam is laid on suddenly on the Engines, it acts like

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a percussion, and affects the wheels as if struck with a hammer; the Carriage, of course, would not be propelled in such case.

Practically, as far as you have seen in the operations of these Carriages, does the wheel slide in that way frequently?—It may sometimes at starting for an instant, but never on the road unless it is over-weighted; I mean, if it has an over-weight attached to it.

Is there much smoke created by your Carriages?—There is no smoke unless any smoky matter gets accidentally into the fire, the fuel being coke; of course there will be smoke if there are coals.

Are you frequently obliged to let off steam?—Yes, but not openly; the steam is allowed to escape from the safety-valve into a chamber peculiarly constructed, which prevents any nuisance from it.

There is no annoyance either from smoke or steam?—There is no annoyance either from smoke or steam, when the Engine is perfect.

Have you found that horses are more liable to be frightened by passing your Carriages, than passing other Carriages?—As far as my own observation goes, I should say about the same; I have travelled with a Carriage, I think, five years, more or less, every week; I have been very frequently in the public streets of London with the Steam Carriage, and the roads round London, and also in the private and public roads in the country; I have certainly seen horses shy often, but never saw a horse make a dead stand.

Is there a very peculiar noise attending the motion of your Engine Carriage?—The noise of wire-drawing, &c. is at the will of the engineer; if the Carriage should make a noise, he has the means of stopping the noise; but there ought not to be any disagreeable noise.

Must not the noise proceed from the imperfection of the works?—Yes, and that only.

Do you attribute the startling of horses to the peculiar noise of the Engine, or to its unusual appearance?—I think it must be from its unusual appearance. It appears from an observation on the Carriages at Cheltenham, made in this Committee, to have been more troublesome than anywhere else; those Carriages were made with curtains, to inclose persons who might ride in them, and the Carriage altogether rather more *outré* in its appearance, from the flapping of those curtains, or some circumstance of that kind, the horses have been startled, or accidents have occurred there.

Are you aware that there is an imperfection in the Carriage at Cheltenham, which is stated to occasion noise?—I have not seen much of these Carriages; I was never at Cheltenham but twice or thrice, and then but for a short time.

What have you found to be the effect of the wheels on a very rough road, full of ruts?—If you start the Carriage from a rut, it takes more power; but when the Carriage is in motion, the momentum takes it over all the inequalities with the usual force.

Do you find that when the propelling wheel gets into a rut, the first power it exerts is in sliding?—Frequently; and sometimes it will be necessary to attach the two wheels, for one wheel will not be sufficient to get it out of that difficulty; the engineer in such case attaches a second wheel by the bolt, and I have never known a situation yet, in which a carriage with both wheels attached will not get out; I have seen it in a clay pit eight inches deep propel itself through, having sunk through the upper surface of gravel in a yard.

When you attach the second wheel, is the increased power owing to the more favourable situation of the cranks?—The power of the Engine remains the same, but the application of it is doubled by friction.

Suppose that both wheels were in the rut?—I have seen both wheels in a rut; in the case I have just spoken of they were both in the rut; in a different state of weather, the effect, hold or bite on the wheels is very different; if the state of the road is between half wet and half dry, it is more apt to slide; and in some instances with a heavy weight attached, we are obliged to go with both wheels locked, when the same weight would have been taken by one wheel only in very wet or dry weather.

Is it only in starting that that difficulty occurs?—Only in starting on a level or slight incline; but up hills we have sometimes been obliged to attach both wheels; the bite only from the one wheel being not sufficient to propel a load behind it.

What is the operation of the propelling wheel when it meets with the obstruction of a large stone on the road?—If the difficulty is so great that the Carriage cannot advance,

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advance, it slips on the stone; but I have blocked up the wheels of the Carriage with square pieces of wood four inches diameter, and started it when so blocked up.

In proportion to the size of such obstruction there is liability in the crank to break?—Certainly; but the cause which occasions a crank to break is one which cannot be explained on common principles; it frequently happens, as in Steam-boats; and very often in this Carriage, when the power applied to it is not equal to its being broken, the accident occurs, and must be referred to a jar or percussion; the axles are unusually large in consequence.

What is the throw of the crank?—Half the diameter of the stroke of the Engine; eight inches and a half to nine inches.

With a wheel of five feet diameter what is the throw of your crank?—About nine inches.

What is the length of the stroke of your cylinder?—I think 16 to 18 inches; the crank is half that. I may state here, that I have had accidents of breaking the crank two or three times during my experiments; the last crank was broken in consequence of going through some rough stones laid unusually thick, I understand as much as 18 inches deep.

What do you anticipate will be the most frequent accident which will happen to your drawing machines?—I should say the derangement of the pumps is most likely to occur, in consequence of which the Carriage would merely stop.

During the experiments you have been making, have you frequently had your tubes burst?—Very often.

Do you conceive you have remedied the probability of such occurrence?—Yes; the first tubes we used were iron gas tubes, which were not welded, but simply "butted" together; the consequence was, that whenever any great pressure came upon them the seam opened; but from practice and experience we found it necessary to wrap over, or over-lap the edges, and weld them from end to end; and now we are not subject to those accidents.

What is the diameter of the tubes of your boiler?—We make them from half an inch to two inches; the best size, I think, is an inch diameter.

To what pressure per square inch do you prove them?—To about 800 lbs.; I think they would bear 2,000 lbs.

What is the greatest pressure they would bear?—It is impossible to say; I have never been able to burst one when well made, when lapped and welded.

What is the average pressure on the boiler per square inch, in your ordinary rate of travelling?—About 70 lbs.

And you have tried the tubes to 800?—Yes; we sometimes may work up to 100 lbs. and 120 lbs.; but that is a case of great emergency.

What is the greatest probable pressure it will be exposed to?—Never more than 130 lbs.; the safety valve blows at 70 lbs. to the inch; it is generally on the lift on a level hard road; I do not think that the pressure is more than 20 lbs. to an inch on the piston.

Is it likely that persons would ordinarily work with the safety valve on the lift?—Yes; or nearly so, sometimes.

Is there not a waste of fuel when you work on the lift?—It will be in proportion to the escape of steam from the safety-valve; the pressure on the boiler is 70 lbs.; on the Engine frequently it does not exceed 20 lbs. to an inch; and when I was asked the pressure I worked at, I supposed the question referred to the pressure on the piston collectively.

What is the thickness of your tubes?—The thickness of the iron is about the eighth of an inch.

What is the thickness of your working cylinder?—It is about three quarters of an inch; it has also ribs round it.

Of what metal is your working cylinder formed?—Cast-iron; we have worked gun metal, but cast-iron appears to be best.

Have you found that there is great facility in guiding those Carriages?—I have always found the most perfect command in guiding them.

Supposing you were going at your ordinary rate of eight miles an hour, could you stop immediately, or would the Carriage run for any distance?—In case of emergency, we might instantly throw the steam on the reverse side of the pistons, and stop within a few yards; the stop of the Carriage is singular; it would be supposed that the momentum would carry it far forward, but it is not so; the steam brings it up gradually and safely, though rather suddenly.

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Supposing you were going at the rate of eight miles an hour, can you say at what number of yards it would be possible to stop?—I would say within six or seven yards.

How would you manage on a declivity?—On a declivity we are well stored with apparatus; we have three different modes of dragging the Carriage.

You have stated that you found no difficulty in guiding the drawing Carriage, or any difficulty in guiding the Carriage which is drawn?—Not the least; it is peculiarly connected, so that the fore wheels of the Carriage drawn follow the tracks of the hind-wheels of the Steam Carriage drawing, although making a circle of 15 feet diameter, which is a singular property.

In what circle do you think you could turn both Carriages?—In a circle of 10 feet, the inner diameter.

Supposing you were going at the rate of eight miles an hour, in what inner circle do you suppose you could turn?—I should be very sorry to attempt to turn within a small circle; I think I might say, probably it might safely be done in one of 100 feet diameter.

In the further progress of the improvement of this description of Carriage, do you suppose that greater weight will be drawn, by adding to the number of Carriages, or by increasing the size of the one Carriage drawn?—The Carriage drawn with its load should never exceed three tons, and the Carriage to draw it should never exceed the weight I have previously stated, about two tons or 50 cwt.; it is possible to draw more than one Carriage on good roads, but I do not think it would be a circumstance of common occurrence.

What have the chief inconveniences been that you have met with on your journeys?—The principal inconveniences we have met with have been minor derangements of some parts of the machinery, such as the valves of the pump being deranged, or tanks leaking, or something of that kind; I never met with any serious accident, except perhaps the first accident in going up Highgate Hill, which was five years ago; the Carriage was not then complete in reference to dragging; I went up the hill contrary to the expectations of every body present, and the workmen were so delighted at it that they neglected to lock the wheel; the Carriage was started down the hill without any drag to it; it became difficultly manageable, and ran against a stone, and was upset. This is the only accident I have ever experienced myself; I believe Sir Charles Dance once upset the carriage in a first essay; those are the only accidents of the kind I am aware of.

It has been stated that one of your engines has blown up at Cheltenham; is that the case?—I am not aware of that; I rather believe that the lifting of the safety valve when the Carriage stops is considered to be a bursting, which I think must be so in this statement; I saw the Carriages the day after the accident of the crank breaking, where it is stated to have burst, and certainly the Carriage had not blown up then; nothing more than the safety valve had lifted; I came to Cheltenham the day after the accident occurred.

What was the nature of the accident which occurred?—The breaking of one of the cranks, occasioned by the extra difficulty the Carriage was placed in; new stones were laid in a hollow of the road, I am told about 18 inches deep; the Carriage had gone through it twice with twenty passengers; the third time it fractured the axle, from the extra force necessary to get it through; the road was in an unusual state; I saw the passengers of a four-horse coach get down in the stones, I was told at the time, by people of great respectability, that all the two-horse coaches invariably put down their passengers; that the mail was stopped; that there were two waggons and two coaches in the stones stopped at the same time, and that they were obliged to exchange their horses to get through.

Has any other accident occurred to that Carriage except that you have now stated?—Nothing that I am aware of material.

Have the wheels of your Carriages frequently caught fire?—Never; I saw the three Carriages the day after the accident; neither one had taken fire; I am sorry such an idea should for a moment exist; I think it has been occasioned by misconception or prejudiced mis-statements.

Is the construction of your boiler and of your fire-place such, that it is impossible for the Carriage to catch fire?—I believe it to be impossible.

You have stated that you require to charge your Engine once in seven miles?—Yes, to charge the tank with water, and to take fresh fuel.

Do you anticipate, in the course of your experience, that you would be able to overcome that inconvenience of being obliged to charge so frequently?—We can

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now go double the distance; but we should have a weight of water and a weight of fuel, a greater expense to carry than if we take in one charge at seven mile stages.

Are the wheels you ordinarily travel with four inches wide on the tire?—From three and a half to four inches.

Have you any information to give to the Committee in relation to the relative wear of the tire of wheels and the shoes of horses?—That is a new horse shoe [*producing one,*] and this is a shoe, of the same size, worn on the streets of London nine days, the shoe has lost about 18 ounces.

Have you any means of ascertaining how many hours a day it had been out?—The horse ran in a cab; it was out a certain number of hours, I think, three or four hours each day; the smith was taking off the shoe which had been worn, and putting on the other, when I asked him to let me have them. The difference between the wear and tear of tires and horse shoes on the roads in the neighbourhood of London are in the proportions of about three-fourths on the shoes, and one-fourth on the tires; but in London, over the streets, about seven-eighths and one-eighth. I would observe, that on railroads, where horses draw the Carriages, the expense of keeping the horse roads is so great, that the proprietors frequently go to a great expense to pave them. From Cheltenham to Gloucester, for instance, and in many other parts of England, this is the case. I would also call the attention of the Committee to some parts of London, where the horses and the wheels continue to pass over the same ground respectively, as in Wych-street; and I would submit the importance of the Committee referring to the expense of keeping the towing-paths of Canals in repair, where only horses, and comparatively few, travel over them. At this moment those are the only means enabling me to speak to the relative wear and tear.

Have you used your Carriages on pavements?—Yes; never to run continually on a pavement, but to run in and out of towns.

Do they run easier on pavements than on ordinary roads?—Yes; they only take about a quarter the power on a pitched pavement; that is, a quarter of the power they would over a gravelled road.

In the progress of this improvement, do you anticipate that it will be necessary to adapt some portion of the turnpike roads to Carriages of this description, or do you think they can be put into operation on the turnpike roads as they are now existing?—I think they can be put into operation on the turnpike roads as they are now existing; I have no doubt at all about it.

You do not anticipate the necessity of paved roads being made for the purposes of those Carriages?—As far as economy goes, in the expense of power, it may be desirable, but for the practical application of the steam it is not necessary.

Can any proportion be drawn between the friction occasioned by the horses' feet and the tire of the wheel?—I do not see how it is possible to do so, unless you take the loss or abrasion of the two metals respectively, in a given quantity of work or miles travelled over.

Have you any practical experience in the repair of turnpike roads?—I have had my attention turned to it, connected only with this subject; I have seen the great expense of keeping towing-paths and horse-paths in repair; and I have seen the great expense of keeping the streets in repair, where horses alone travel; and I have seen the great wear and tear of iron shoes, when compared with the wheels of carriages.

Have you any plan to submit for fixing the Tolls on Steam Carriages?—The plan I should propose would be, if I may be allowed the term, that an iron horse of the same weight as one of flesh and bones should pay the same toll; and taking one horse to weigh 10 cwt., that for every 10 cwt. the Steam Carriage weighs, it should pay the same toll as one horse pays; although I do not admit that the same weight carried on four wheels will do as much mischief as on four hoofs. If we take the Turnpike Acts, and look at the comparative rate of tolls charged when a horse is drawing and when he is not drawing, I shall be, I conceive, borne out in my position.

Can you point to any clause in Private Bills which press more than you conceive they should on Steam Carriages?—There is one, the Liverpool and Prescot Road Bill, this Session, charging a toll per horse-power, which it is difficult to determine; my objection to that is, that if the horse-power is taken as the nominal Engine horse-power, a Steam Coach would have to pay 2*l.* 8*s.* where a stage coach pays only 4*s.* a toll. The next is the Bathgate, near Edinburgh road, where the

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tolls are on weight, and an Engine of three tons (about the usual weight of a loaded four-horse stage-coach), would have to pay 1*l.* 7*s.* 1*d.*, when four horses would have to pay 5*s.* The next is the Ashburn and Totness Road Bill, where 2*l.* would be charged on the Steam Carriage and the Carriage attached, being 5*s.* on each wheel; four horses, at the same time, would have to pay 3*s.* The next is the Teignmouth and Dawlish Roads; they are in the proportion of 2*s.* and 12*s.*

What is the most favourable instance to Steam Carriages?—The Metropolis Roads near London charge 1*s.* for four horses, and 2*s.* for the Steam Carriage and the one drawn; I complain of that because it limits me to a particular kind of Carriage; I am building one which will not weigh more than 5 cwt. and carry only two or three persons, and it would be excessive to have to pay 2*s.*; there is no reduction if it is no bigger than a wheelbarrow; being propelled by machinery, it will be charged double.

How many Private Bills have been introduced this Session in which Steam Carriages have been specially taxed?—I have fifty-four, which I now produce; I understand there are others.

Have any of them passed into a law?—Yes, some of them have.

In your opinion, what proportion of the tolls should horses and carriages be chargeable with?—Taking the average of the amount of tolls throughout the country, it will be found that where a horse pays a penny not drawing, he pays about three-pence when he is drawing; in that case the toll upon the coach is nominally put upon the horse (it says, so many horses drawing); four horses drawing will be a shilling; four horses passing through, not drawing, will be four-pence; in some cases it is three half-pence a horse when not drawing, and sixpence when drawing; but in general the proportions appear to be, three-eighths the toll placed upon the horse, and five-eighths upon the carriage; three half-pence a horse not drawing, and sixpence drawing, gives three-fourths; but the mean is about three-eighths and five-eighths; so that the toll is virtually about five-eighths on the carriage, and three-eighths on the horse. I have previously stated that I have had horses weighed, and found the average about 10 cwt. each horse; therefore, if a Steam Engine weighs 10 cwt. it should pay only as one horse when it passes through not drawing, and as one horse drawing when it has any thing attached to it; a 10 cwt. Steam Engine cannot propel more than one horse can draw; therefore the weight drawn cannot exceed a certain quantity. If the weight of the Engine exceeds 10 cwt. and not 20, it should pay as two horses; if it exceeds 20 and not 30, it should pay as three horses; if 30 cwt. and not exceeding 40, it should pay as four horses; and so on.

Practically horses drawing frequently draw a weight of 30 cwt.?—Yes, sometimes, but 15 cwt. a horse is the usual weight. I have always felt a great anxiety that the weight of the Steam Engine should not injure the road, and I have felt desirous of not introducing it until it was reduced; and I now cheerfully admit, that if the weight of the Locomotive exceeded 60 cwt., which is the weight of the present loaded stage coaches, with the passengers and their luggage, there should be a very heavy toll put on them. I would also propose that if my wheels are wider than four inches, the tolls should be less; if they are six inches, then they should be still less; but taking the principle of 10 cwt. of iron and copper to do the work of one horse, and that it should pay the same tolls, and that no weight of Steam Carriage should be admitted above 60 cwt. on the road, I certainly should myself be content, and as I cannot for a moment imagine that the 10 cwt. running on four wheels can do so much harm as 10 cwt. carried on four feet, that the interests of Turnpike Trusts would be fairly preserved by such a scale of tolls.

What is the amount of toll charged between Gloucester and Cheltenham?—Five shillings and sixpence.

What would be charged on a four-horse coach?—Two shillings and eight-pence.

Your Steam Carriage, according to the last improvement, weighs 35 cwt. without the weight of persons to direct it?—Yes, and without the weight of the fuel.

Do you not consider that the Steam Carriages would be applicable not only to the moving Carriages at a rapid rate, but also to moving certain weights at a slower pace?—I think it is possible, but it would be very expensive, because I find that when you get below a rate of four miles an hour, the expense in fuel is greater than the expense in horses; if the rate exceeds four miles an hour, then it is cheaper, and it becomes cheaper geometrically over horses as you get up.

What is the greatest weight which you conceive your Steam Carriages could draw after them on a level road, at the rate of four miles an hour, the Carriage weighing

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two tons?—Every 10 cwt. in the Engine would draw what one horse could draw, so that two tons would draw as much as four horses.

Will the rate of tolls you have remarked in the Bills you have produced, prohibit the use of Steam Coaches on these roads?—Certainly.

What do you calculate to be the comparative expense of running a Steam Carriage and running a coach with four horses?—That varies in different situations, according to the price of coke and the price of labour; it is in all cases considerably less, at least one-half less.

You anticipate that the principal use of Steam Carriages will be the conveyance of passengers and at one half of the expense at which they travel now?—Yes; and in less time.

Can you deliver in to the Committee a detailed estimate of the expense of running a Steam Coach, and one of running an ordinary coach?—Yes, I will prepare them.

At what rate do you suppose it would be safe to run Steam Carriages on the public roads?—I have run them safely eighteen and twenty miles an hour; but twelve miles an hour is perfectly safe and practicable; the rate will be determined by practice principally; in directing the carriage at present there is no difficulty or danger in guiding the carriage at this rate.

Would there not be danger in passing a carriage drawn by horses?—If the engineer was careless it might be, but not with care; a mail-coach travels far beyond that at times.

You make your wheels cylindrical?—They must be cylindrical, for they turn with the axles.

None of yours are less than three inches now?—No; three inches to three and a half, even where the Carriage weighs two tons weight.

Veneris, 5^o die Augusti, 1831.

Mr. Goldsworthy Gurney, again called in; and Examined.

WILL you give in the Statement that you were directed to produce on the last Examination?—I will.

[The Witness delivered in the same.]

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CALCULATION as to the relative Expenses betwixt HORSE and STEAM POWER for Locomotion.

In order to estimate the comparative expense between *Horse* and *Steam Power* for drawing Carriages on common roads, I will take the relative expense on 100 miles of ground for working a common stage coach *by steam* and *by horses*.

The first cost, wear and tear of the coach *drawn*, in every respect is the same in both cases.

The expense of men to manage is about the same also. In one case there is a coachman and guard; in the other, an engineer and director.

Government duty and *turnpike tolls* must also be considered the same.

It remains then to show the difference in the expense of *POWER* only; viz. betwixt the expense of Horses and the expense of Steam. First in the outlay, on 100 miles of ground. To work a coach well with horses 100 miles up and 100 miles down once a day, will require 100 horses. A horse a mile is the present calculation for doing the work. If these horses be taken at £.20 or £.30 per horse, or say £.25, it will amount to £.2,500. Three Steam Carriages will do the same work, and the expense of these will be about £.500 each, or £.1,500 for the three. A saving will consequently be effected in the first outlay of £.1,000 in capital.

The wear and tear of horses may be estimated at about £.5 each per annum on the 100 horses; viz. £.500 per annum.

The wear and tear of the three Steam towing Carriages will not exceed £.100 each per annum; £.300 for the three; saving in wear and tear, £.200.

The expense of shoeing, keep, provision, attendance, harness, &c. is per day somewhere about 3s. each, or £.15 upon the 100 horses.

The expense of fuel for two carriages, one up and the other down, doing the same work, will be that of 100 bushels of coke at 6d. per bushel; say £.2. 10.

Or if we take 1s. *per mile* per horse power, it will be about the same. The expense of fuel for the Steam Carriage will be, on an average throughout England, about 3d. In some coal districts it will not exceed 1d. per mile; while in other situations it will amount to 6d.

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I have not taken into this estimate the expense of stables, which is considerable when compared with sheds for coke and water.

From these data I conclude the Carriage may be worked by *Steam* at one-fifth the expense of Horses.

A B S T R A C T :

HORSE POWER.	£. s. d.	STEAM POWER.	£. s. d.
Outlay for horses - - -	2,500 - -	Outlay for Steam Carriages -	1,500 - -
		Balance of saving in the outlay in favour of Steam Power - }	1,000 - -
Wear and tear of Horses, per annum - - - - }	500 - -	Wear and tear of Steam towing Carriages - - - - }	300 - -
		Balance, saving in tear and wear in favour of Steam Power - - - - }	200 - -
Shoeing, keep, attendance, pro- vision, harness, &c. per day for 100 Horses - - - - }	15 - -	Fuel for Steam Carriages, half bushel per mile travelled, at 6d. per bushel - - - }	2 10 -
		Balance, saving - - -	12 10 -

Have you any additional Evidence to give to the Committee, on points which you have considered after your last examination?—I have no further Evidence in connection with the practicability of the Carriage.

Would you wish to explain your former Evidence, or to give any additional Evidence upon the subject?—On looking over the Evidence I find it correct; I should observe, in explanation, that at 3s. a day I have taken in the wear and tear of the horses, and the attendance, and the fuel.

How long are your boilers calculated to last?—About three years fair treatment.

How frequently do they require examination?—Once a fortnight or three weeks; it depends on the situations where they work, in some situations where lime is held in solution in the water in large quantities, they require cleaning oftener, but in other situations where there is very little earthy matter held in solution they will run for a month or two months.

Is there a facility of cleaning them?—There is, from recent improvements in cleaning, very great facility.

Is there any expense attendant on the operation of cleaning?—One days' work of a labourer, their not requiring an engineer.

You have stated in your former Evidence that it would be unjust to put a toll on Steam Carriages according to the nominal horse power of the Engines, will you state why it would be unjust to put a toll in that way?—Because I conceive at present there is no standard by which we can fix a horse power.

Will you state to the Committee the variations of rate at which the different Engineers have calculated horse power?—The most generally received standard is 180 pounds at two miles an hour, say from 150 to 200.

Could there be any fair system of toll established by the length of stroke, and the area of the piston?—I think not; the length of stroke and the area of piston will give power in proportion to the pressure of the steam upon it; the apparatus for supplying or generating the necessary steam would vary considerably in weight in different Engines; and therefore the weight of different Engines would vary so much perhaps as three times or four times.

Would there be any objection to placing toll on an Engine according to its greatest power of working?—I think it would be very difficult to ascertain its greatest power of working; it might be done, but it would be very inconvenient.

Are there no means of ascertaining the average power of working?—Horse-power is very arbitrary; the best standard which I can give, is the evaporation of water, and I should say that the evaporation of nine gallons of water in an hour, ought to be equivalent to one horse-power. One Engineer will apply the steam with more effect from nine gallons of water, and with more general advantage than another; nine gallons may be taken as an average.

What is the diameter of your cylinder, and what the length of stroke?—I believe I have

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I have given the length of stroke in my former Evidence, but not the diameter of the cylinder. The diameter of the cylinder now used is about eight inches, offering 64 circular inches area on the piston.

Is there not on those engines an average rate of expenditure, not speaking with mathematical certainty; is there not the means of calculating pretty well the expenditure necessary to work them?—The expense of fuel for working them is well ascertained.

Having ascertained that it will evaporate nine gallons of water in an hour, you come pretty nearly to the expenditure of one horse power?—It does not follow in all cases, that one horse power will be practically produced from nine gallons; and on the other hand I may state, that I have seen a horse power produced from five and six gallons.

At what pressure?—It does not signify much at what pressure.

You say that the evaporation of nine gallons of water is equal to one horse power; does it not make a difference according to the pressure?—This is a point unsettled at present by Engineers; some advocate high, others low pressure.

You have stated, that if you wished to increase the power of your Engine, you would increase the weight of it, and decrease the size of the wheels?—It might be done either way; the union of the two is not necessary as far as regards the intensity of power; the quantity of power must be produced by an increase of weight, or by some increased or rapid formation of steam.

What is the weight of a loaded waggon, with horses?—At this moment I am not prepared to give an accurate answer, but I should think six tons.

Does that include the weight of the horses?—No.

What should you judge to be the weight of the horse usually attached?—From 14 to 16 cwt. each horse.

Would not you, by increasing the size of the cylinder, increase your power?—Yes, in direct proportion with the increase of the area.

What objection do you see to increasing the size of your cylinder, and applying it to a large waggon, so as to use Steam Carriages for the mere carriage of goods?—I think the difficulty and objection lies in the management practically; it would be difficult in our present stage of knowledge and experience to manage a large cylinder very rapidly on the road; but I see no other obstacle to great speed; there is no theoretical difficulty. I would wish to state, in connection with my former Evidence with respect to fuel for working slowly heavy Carriages, that my opinion was founded on some peculiar laws of momentum lately observed; it is well known that one Engine, when worked at a given rate, works expansively; that an Engine working at a quicker rate, if a piston only travels half a mile an hour, or 50 feet a minute, it will require more fuel for it to do a given work, than if working at 200 feet a minute.

Is not the momentum gained by greater velocity an accumulation of power?—I think the advantage gained by certain rapidity of action, arises from the inequalities of the road being overbalanced by the momentum of the Carriage; when the Carriage travels slowly, every inequality, every stone or slight obstacle partly destroys the momentum, but at a certain speed it overcomes them; there is no actual gain of power by momentum; it is only an accumulation very much like that in a common fly-wheel; and in a Carriage on a common road, it acts on inequalities as a fly-wheel does, in overcoming unequal obstacles in machinery.

You use coke only?—We occasionally may use charcoal, but very seldom.

What is the proportion in price and what in value between coal and coke?—I think one bushel of coals is equal in raising steam to two bushels of coke.

What is the difference of price on the average?—The difference of price is, I think, about two-thirds.

Then there would be a loss as compared together in using coke?—Coals would be much cheaper than coke, but that loss in the expense of fuel we are disposed to suffer rather than produce a nuisance on the road by smoke.

Do you conceive that there can be no mode of escaping that by any smoke-consuming apparatus?—I know of no mode that is likely to succeed, nor do I conceive that it is possible to make such a combustion of coals that is likely to consume all the sublimated or volatilized matter; the consuming of smoke or the combustion of smoke is prevented principally by the particles being mechanically mixed with or surrounded by carbonic acid gas. I believe it not to be chemically combined.

Would not the motion of the Carriage and the current of air that is produced by going quickly through the air, give great facility in the application of a smoke-con-

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suming apparatus?—If the consumption of smoke depended on the presence of oxygen gas or atmospheric air which contains it, I think it would ; but on my previous reasoning, I do not think the consumption of smoke would be effected by any quantity of atmospheric air. I have made several very extensive experiments on this subject, and the only experiment that I have succeeded in, was by passing it through sand mixed with quick lime, by which the carbonic acid was absorbed, and the smoke as it passed through the mixture rendered combustible ; the carbonic acid was removed to a considerable extent, and left the carbonic oxyde and hydrogen gas in such a free state as to be combustible.

Of what materials are your propelling wheels?—The same as a common stage coach wheel.

Are the wheels of the Carriage drawn nearly of equal diameter with the wheels of your drawing Carriage?—Rather less ; the diameter of the wheels of the drawing Carriage is about five feet, and the ordinary diameter of a stage coach that is drawn is about four feet six.

From the experiments you have made, supposing the drawing Carriage and the Carriage drawn were of equal weights, what do you think would be the different proportion of weight on the wheels?—None.

Do you speak that with any certainty?—Yes, I do. I have taken the loss of iron upon coaches after knowing the number of miles they had travelled over, and the loss of iron on the Steam Carriage, and the number of miles it had travelled over, and find that the loss in both cases bore the same proportion.

Is coke alone used on the railways in the locomotive Engines?—On the Manchester and Liverpool railroad, I believe there is a clause in their Act to prevent any nuisance being made by smoke, and coke is therefore used ; but in the ordinary railroads in Wales and other places, coal is used.

In what part of your Engine is your safety valve situated?—It is situated at the option of the Engineer ; frequently in the steam pipe leading from the boiler to the Carriage, most generally ; so that the steam as it passes through that pipe may lift the safety valve, or it may go to the Engine, as the state of pressure shall determine.

Do you make use of one or two safety valves?—Only one. I occasionally use two, but we now use only one.

If your Carriages were brought into general use, would you suggest that two safety valves should be required, one out of the reach of the Engineer to prevent accidents occurring from racing, or other causes which could induce the guide to increase the pressure of Steam?—I should recommend one being locked, and an Inspector being appointed to examine it every journey. Perhaps I may be allowed to make an observation or two with respect to the bursting of boilers, which subject, I believe, is now under consideration. From experiments which I have made in connection with this subject, I am led to believe that the bursting of boilers is not always occasioned by pressure of steam. I have discovered that at a certain degree of temperature and under certain circumstances, when water is decomposed, that the hydrogen is often formed into a new state of combination with oxygen and nitrogen gas, which compound is exceedingly explosive ; so much so, that I believe scarcely any provision that we can make in the shape of a safety valve, would protect the vessel. This was a subject which I was led to some time ago, from some observations which I had made on the combinations of oxygen and hydrogen only. I had some conversation with Gay Lussac on this subject, and he was of the same opinion with myself, particularly that there were different chemical compounds of hydrogen and oxygen gasses which at present were not acknowledged. The only one acknowledged in this country is that forming water. A compound of two proportions in volume of oxygen and two of hydrogen, has been chemically combined in Paris, although I believe we never have succeeded publicly in this country. This compound was highly explosive when brought in contact with certain substances.

It would be by expansion?—By chemical contact ; if brought into contact with certain substances, it would be so affected as to produce explosion. I have reason to believe from some original experiments, that there is a compound of these elements produced under certain circumstances in steam boilers. The want of water in a boiler is favourable, in which case the temperature is raised and the compound formed ; the bursting of boilers I believe frequently takes place, from this compound coming in contact with substances that will decompose it, and perhaps I might mention this fact, as it is a very interesting one, namely, that boilers often burst when the valves are known to blow at a pressure very considerably lower than the boiler has been proved to.

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Does not that take place also when the water is in the boiler?—If the water is low in the boiler it will take place; if it is high, never.

Has it not frequently happened that boilers that were calculated for a higher pressure, have even burst at a lower pressure than they were intended for, when water is in them?—When water is high in them, never; but when it is so low in them as to form this chemical compound, it does. I would state a fact, which was mentioned to me by my friend Sir Anthony Carlisle, which throws considerable light upon the subject, and first led me to my suspicions and experiments respecting it. The case was, that a boiler at Mr. Meux's brewery, with an open top—a common cauldron—burst with a violent explosion. I believe one man was killed, and two very severely scalded. There was no cover at all on the vessel. This phenomenon, upon inquiry, appeared to be occasioned by gelatinous matter, forming a crust, a film, or blister, and prevented the contact of water with the bottom of the boiler; the bottom of the boiler, consequently, got hot; the compound I alluded to was formed, or the rupture of this film, and the sudden contact of water against the hot surface below, produced such an immense and sudden volume of steam that it burst the boiler. I would explain it by saying it was analogous to the bursting of a gun, in which case an ounce or two of shot is placed only against the charge; whenever there is a sudden formation of elastic matter, and there be ever so small a weight opposed, the shock will be very great, and a gun will frequently burst, though there is not an ounce of shot in it, and which charge may be considered in the light of a safety valve in this case.

What precautions have you taken in your boilers, that there may be no probability of their being without water?—This compound never forms without a certain raised temperature. Before this temperature, necessary for decomposition, takes place, it melts a fuseable compound alloy of metal, placed so as to allow of its escape; the matter formed escapes, and all danger is prevented.

Have you any precaution to prevent the water escaping out of your narrow tubes, by bubbles of steam?—Yes; that I would explain by reference to the first drawing, (No. 1.) which will show that the bubble of water, as it escapes from a tube in connection with a part of the boiler, is supplied simultaneously from the lower part of the tube, and a stream of water is thus made constantly to pass through.

Would not that stream of water act as a safety valve?—When there is water it is sufficient, but when water gets down in any boiler there is no safety valve that will protect it, and hence arise the inexplicable accidents that have occurred frequently in steam boats; the size of the boiler is the only protection without the safety alloy.

Have you any gauge, or means of ascertaining when there is a deficiency of water in the boiler?—Yes; the melting of the safety plug, I would state, only takes place in cases of great negligence, or in cases of extremity. The gauge by which we ascertain the quantity of water in the boiler is the common glass gauge, well known to those acquainted with the subject.

Have you any guage to examine the intensity of the steam?—Yes, we have a piston which is forced out in proportion to the pressure; in addition to the glass gauges there are also stop cocks, so as to ascertain, by turning them, the actual height of water. I beg to state, that the safety plug has never, but four or five times, given way in all my experiments, and that has been in cases where we have been accidentally out of water in our tanks; no personal mischief can arise from such an accident. I am satisfied, without this plug an explosion would have taken place in some of the tubes. In large boilers, under those circumstances, inevitable destruction would have attended it.

Are you aware of the size of the cylinders and stroke of the Engines on the Manchester and Liverpool rail-road?—I believe them to be ten inches diameter, and about fourteen inches stroke. In some of the later Engines I believe they have been made of fourteen inches diameter, the stroke being the same; but I rather think that that size has been given up, and that they have returned again to the ten inches diameter.

What is the greatest weight, in proportion to its own weight, which any Carriage draws on a railroad?—A Carriage was originally supposed to draw only three times its own weight on a rail-road; but in some experiments which I made in Wales with Mr. Crawshay, of Cwrfaithfa Castle, we found, in an experiment, that a Carriage draws thirty times its own weight. He has the minutes which we made upon the occasion; but I believe, in practice, they scarcely exceed five times, or from five to ten.

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You have stated that in your Carriages you do not anticipate drawing more than the weight of the Engine?—Practically, on the common road, weight for weight. I explained in my former Evidence, that it was possible to do more under favourable circumstances; but circumstances vary so much on the common road, that we ought not to calculate on doing more than weight for weight.

The diameter of your steam-wheel is rather greater than the diameter of a carriage-wheel?—Yes; the size of the wheel I proportion to the Engine, so that the piston may work under the most favourable circumstances.

It is by experiment simply that you have arrived at your present size of cylinder?—Yes.

You stated in your former evidence, that you anticipated that passengers would be carried at one-half the rate by your Steam Carriages that they are by the common carriages, what difference in the ordinary expenses of carriage would it make if you had a paved road for this purpose?—I think that it would reduce the expense to one-half again.

If there were properly paved roads, you conceive that passengers might be carried at one fourth the present expense?—Not exactly; because the total expense includes the government duty, tolls, &c. as the same; but as far as the steam-power is concerned they would. These subjects have been inquired into by a mathematical friend of mine, and he has published the result of his inquiries, which I will take the liberty of delivering in.

[*The Witness delivered in the same.*]

You have stated that in certain states of the road you find increased difficulty than in other states?—I have; and the difficulty arises from a mechanical application of the steam simply; namely, in consequence of the road being in a greasy state, and the wheels therefore more easily slipping, and under the circumstances do not furnish so good a fulcrum for propelling.

Have you ever watched the operation of your carriages in snow?—I have; I have used them both on snow and on ice. On ice, a very little roughing of the wheels is necessary, in the same manner as you rough horses, and little power is sufficient to propel the Carriage, because under those circumstances, the power to draw the weight is very considerably reduced, and therefore the full power of the Engine is not necessary to be exerted: in deep snow, there certainly is great difficulty; but I have no doubt that as the subject goes on improving, all those practical difficulties will be overcome.

The difficulty would be greater in your Carriage than in other Carriages, would it not?—I think not; I think the Carriage might be so constructed as to remove the difficulty.

Will you state the effect of ice below, and snow above, upon the action of your Carriages?—I have had occasion, in two or three instances, to use the Carriage under those circumstances, with a view of judging of the practical result of it; and I have not found any difficulty in its progress. The snow is pressed strongly under the wheel, becomes almost immovable, and furnishes a good fulcrum for the wheel; a little preparation only is necessary, and a very little is sufficient to overcome any moderate obstacle of that kind. May I be allowed to give in to the Committee a scale of what I conceive to be an equitable toll on Steam Carriages? it is the same in principle as I gave in on my last examination, but is extended.

[*The Witness delivered in the same.*]

Sic in orig.

To what width could you extend the tire, without any inconvenience to the working of your Carriage?—At present I cannot say to what limit it may be carried, but six inches would be no inconvenience.

Then your Carriage would go with six inches tire?—I think so; and under certain circumstances easier, where the crust of the road is hard.

Would not that depend very much upon the road?—It would; I would state general principles: I would submit to the consideration of the Committee, better to explain my meaning, that it frequently happens that a frost forms a crust sufficiently hard to support the weight of a Carriage a ton weight, but that it breaks under one or two tons; the power required to draw two Carriages respectively so circumstanced is so great, that I can give you no data for estimates off-hand; but it is evident, that the power of drawing a one-ton Carriage would be little compared with the proportion of power required for drawing two. My answer to the question is, generally, as I find the public roads at this time.

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To what velocity could you increase your present rate of travelling with your Engine?—I have stated that the velocity is limited by practical experience only; theoretically it is limited only by quantity of steam; 12 miles, I think, we might keep up steadily, and run with great safety. The extreme rate that we have run is between 20 and 30 miles an hour. I stated in my former Evidence, that the Carriage when upset by Sir Charles Dance, was at that time going at 18 miles an hour, but no injury happened either to the machinery or the persons upon it; still I am of opinion, that that speed might be maintained with perfect safety by a little experience in practical management.

What are the practical objections to going at that rate?—I think the principal objections are want of real knowledge and experience; I have been so many times disappointed in what theoretically I had imagined true, that I am afraid to give a decided opinion on subjects not practically proved.

Have you any thing further that you wish to state to the Committee?—I would state generally, in regard to the main improvements on Steam Engines, by which this country has been so much benefited, and the prospects of advantages arising from Steam Carriages, that they have almost always been in a direct ratio with that of removing of horses; that the great and splendid improvements of Mr. Watt have generally been supposed to be principally connected with the separate condenser of the Steam Engine, and the saving of the fuel; but before Mr. Watt's day, we could empty our mines of water in Cornwall, and we could do a variety of other simple work by the Steam Engine, and so far the improvement of Mr. Watt was simply with respect to the saving of fuel; but I consider that the great national advantage arising from Mr. Watt's improvement, has been his application of the Steam Engine to machinery; and the extent of that advantage to the community has been in a direct proportion to the removal of horse power, a most unproductive labourer and a dead expense to the country. If this view of the subject be entertained, the application of steam to propelling Carriages on common roads will be as important above its application to machinery generally, as the number of horses employed in locomotion exceed those necessary to machinery, which bears no proportion with respect to each other. At Hounslow alone, there are at this moment upwards of 1,000 horses employed in stage coaches and posting. On the Paddington Road, a distance of five miles only, there are upwards of 1,000 horses employed at this moment. Throughout Great Britain it is almost impossible to say how many horses are employed, but I should perhaps be within bounds if I were to say millions, in posting and stage coaches. If it is possible to remove those horses by an elementary power, which I firmly believe is practicable, the national advantage must be in proportion to the number of horses so removed; for if it is shown that one carriage horse can be removed from the road by the present state of Steam Carriages, I see no reason why every horse so employed should not be so removed. It has been decided that the consumption of a horse is equal to that necessary for eight individuals, so for every horse that is removed and is supplied by elementary power, we make way for the maintenance of eight individuals. If it is possible to carry the idea so far, and I see no objection to it, to do the principal work of horses by steam, or if it can be done by elementary power, the Committee may imagine to what extent we may provide for our increasing population. I think we may do much by political laws and enactments, but natural laws will do more, and when pointed out by the finger of Providence, may be made to provide for his wise dispensations. I firmly believe that the introduction of Steam Carriages will do more than any other thing for this country; I have always had this impression; I left an honourable and lucrative profession, in which I was extensively engaged, in order to attend to this subject, because I was convinced of its importance and practicability; I have always entertained the same idea as I do at present. Imperfections will exist in the machinery; but I conceive that the main points of difficulty have been removed by the experiments I have made, and that all those now remaining are practical difficulties, which will be removed by further experience; and if there is no cause opposed by the Legislature, or any other source, I will be bold to say, that in five years Steam Carriages will be generally employed throughout England. I have not hesitated, having these feelings, to devote all my time for the last six years to the subject, and am mentally recompensed by the present state of the subject. Private carriages also will be used. Under this opinion I have given directions for building a small one. I expect it will go quicker, safer, more easily, and certainly more independently than a common carriage, because it does not need the food of a horse.

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Do you apprehend much decrease in the price of your Engines?—I do, and I also anticipate that steam will be supplanted by the use of other elementary power; but I do not think that will take place in our day. I think that steam will be generally introduced, and that the public will feel the importance of it; and that scientific men will be directed to examine and employ in its stead other substances, and new compounds are continually turning up, and some will eventually be applied to mechanical purposes.

Do you believe that there will be other ways of raising steam?—I do not now speak of steam, but certain compounds; I do not specify any particular compound at this moment; I state those generally which are known to produce power by chemical change; some peculiarly explosive and æriform bodies for instance. I am informed that at present there are between 20 and 40 different Carriages building or about to be built by different persons, all of which have been occasioned principally by the decided journey which I took of 200 miles in 1829, and which convinced not only the public of its practicability, but also some of those very men who are now employed in this object, and who previously had laughed at the idea, and considered it chimerical.

In what particular point of machinery does your patent consist?—I have three patents, the first for the boiler, the second for the peculiar application of it, and the third for improvements that have been made since.

Do you anticipate much saving of fuel in your future experiments?—I do; I think the saving of fuel will be in proportion to the saving of water.

That is, that there will be a saving from the better application of the fuel and boiler?—Yes; and from the general improvements in machinery; for instance, it is an unsettled point at this moment whether a pressure of 20 lbs. to an inch, or 120 lbs. to an inch, is best; it is not yet decided, which time will decide.

Do you cut off your steam, so as to work expansively?—Yes, we generally work expansively.

You have mentioned that various accidents had happened to the crank of the Engine, which were not accounted for; have you in contemplation to effect any change in the application of the power?—At present, I think the crank the most simple; in some of my first experiments I worked with a chain passing over two wheels from one to another; also by a rack and pinion, and various motions of that kind; but I think that nothing is equal to a crank, that also is the opinion of others besides myself. Upon the Liverpool Rail-road they first applied the power to the outside of the wheel, but they have come to my drawing (No. 3.) at last, and they now work by the crank on the axle; this practically confirms my opinion. There is one observation which I would at this moment make in connection with my former Evidence. I have been frequently asked, what would happen in case of an accident happening to the guide or director, in case he falls asleep, or in case he is disengaged from his seat. I have provided for all those casualties, distant as they are, by making the valves of the Engine only remain in gear when the guide is in his proper situation; the moment he is thrown off his seat, by accident or otherwise, the Engine instantly stops.

Does that depend upon the guide's weight?—No; it is by his foot he keeps the valves down, and the effect on the Carriage when he takes it off is very singular; I merely mention that fact in connection with the practical detail and safety of the Carriage, the same contrivance, by simply lifting the foot, prevents the Carriage running down hill too quickly, and we do not require the complicated drags that were before used.

Mr. Walter Hancock, called in; and Examined.

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ARE you the proprietor of a Steam Carriage running on a turnpike road?—Yes. How long have you been running that Steam Carriage?—I dare say about a twelve month this present coach, but I have been working for hire on the road only a month.

Are you the inventor of that particular description of Engine that you make use of?—Yes.

Will you state the progress which you have made in the improvement of your Steam Carriage?—The principal improvement I consider is in the boiler, that of constructing the boiler much lighter than any that are now in use.

Will you be kind enough to give a general outline of your plan?—There are flat chambers which are placed side by side, the chambers being about two inches thick, and

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and there is a space between each two inches ; there are ten chambers, and there are ten flues, and under the flues there is six square feet of fire, which is the dimension of the boiler top and bottom ; the chambers are filled from half full to two-thirds with water, and the other third is left for steam, there is a communication quite through the series of chambers top and bottom ; this communication is formed by means of two large bolts, which screw all the chambers together, the bottom bolts the bottom part of the chambers, and the top bolts the top part of the chambers, and by releasing those bolts at any time all the chambers fall apart, and by screwing them they are all made tight again ; we have braces to fasten them ; the steam is driven out from the centre of one of the flues, and the water is ejected from the pump at the bottom communication for the supply of water.

Does the fire pass between the boxes, or does it pass through them ?—It passes only between them.

There is no line of communication for the fire made between the boxes ?—Nothing more than the flue through which the fire passes ; the sides of the boilers form the chimnies.

Have you ascertained what pressure such boilers are equal to ?—I have never gone beyond 400 lbs. on an inch ; I have worked it on a road at 400 ; the average pressure on an inch is from 60 to 100.

At what pressure do you set your safety-valve ?—Taking the average of roads, I work at about 70 lbs. upon the square inch.

You have calculated how many square feet of boiler ?—At the present Carriage I have 100 square feet of boiler exposed to the fire.

What distance do you run from stage to stage ?—What I consider the stages I have run is four miles ; but every eight miles I take in water ; I go there and back.

You consider your stage eight miles ?—Yes.

Do you take in both water and fuel at the end of a stage ?—Yes, at the end of every eight miles.

What quantity of water and what quantity of fuel do you use for each stage ?—About 7 cwt. of water, and sometimes eight ; it depends upon the roads ; we consume more steam when the roads run heavy.

How much coal or coke do you use for each stage ?—About two bushels of coke.

Do you mean that you take two bushels at the commencement of each stage ?—I take more with me, but I always consume a quarter of a bushel per mile.

You do not in that include your first charge of coke when you set off ?—No, that would vary according to circumstances ; if I were in a hurry, I could get the steam up in five minutes, but the average time is about twenty minutes in getting up our steam, and we do not consume more than a bushel.

That is at first starting ?—That is at first starting.

Do you apply a second Carriage to your Engine for passengers, or do you carry them in the same Carriage ?—The boiler is placed behind the Carriage ; there is an engine-house between the boiler and the Carriage ; the Engines are placed perpendicular between the passengers and the boiler, and the fore part of the vehicle is for the passengers, so that all the machinery is quite behind the Carriage, and the fore part of the Carriage entirely for the convenience of passengers.

Where does the guide sit ?—In the front, the same exactly as a coachman in a common stage.

How many passengers have you carried ?—We carry ten ; but I am making provision to carry fourteen.

What is the weight of your vehicle ?—I should imagine about three tons and a half.

Have you ever weighed it ?—Not this Carriage ; but the Carriage I had before, the vehicle itself with the engines and boilers, weighed three tons ; I consider the present Carriage to weigh from three tons to three and a half tons, with fuel and water.

Have you found the rate of tolls that have been charged at the turnpike gates very high ?—On the City Road toll I have paid a shilling ; I do not know whether it is according to proportion, for it was a thing that did not embrace my attention at that time ; but the highest toll that I have paid is a shilling ; but on the road that I run from Stratford to London they told me they would not take it ; they would take it another day.

What effect do you think your Carriage has upon the road, in proportion with a carriage equally loaded, with four horses ?—I think, myself, we should rather

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improve the roads by the operation of our Engines, because a Steam Coach requires broad wheels, perfectly upright and flat on the outside of the tire.

What is the breadth of the tire?—The tires of the present wheels are about three inches and a half.

What is the diameter of the hind wheels?—Four feet. That is not a proportion that I consider to be working as a profitable diameter; I consider that the diameter that should be used for a Steam Coach is at least five feet.

How wide could you make that tire without losing power?—It depends on the weight; but taking the common coaches, I should say from six to eight inches.

Without injuring the power?—I have no doubt it would be no drawback on the power.

Do you consider that such breadth would be as good as any other, the best you could make?—Yes; because a broad wheel on gravel is considered to be a great advantage; it is a great disadvantage on a road which is between wet and dry; but in those cases we have always an overplus of power blowing off at the safety valve, and from that circumstance I am rather pleased at having rather a dead road to run upon, because we are obliged to construct the vehicle so as to overcome all obstacles in the road, such as dead gravel, &c.

To how many of your wheels do you apply your power?—To two; occasionally one.

Do you apply it to a crank?—The axletree of the present Carriage is made precisely the same as the common axles now in use, straight and merely bent at the end, and I have a chain which I put on the nave of the wheel, and that communicates with a corresponding chain wheel on the crank shaft of the Engines.

What is the size of the circle on the wheel to which you apply your chain?—About ten inches.

How wide is the corresponding circle on the crank shaft?—The corresponding pulley of the shaft is just the same; so that the power of the Engine is the same exactly as though it were applied to the wheel itself.

You have two wheels; how do you move the first wheel?—There are two Engines working on two cranks, exactly on the same principle as used in common for Steam Coaches; I take the chains; I place the Engines four feet from the axletree of the hind wheels, and the communication of the chain is to allow me to put my work on the springs, and the play of the carriage up and down is accommodated by the chain.

Is your cylinder on springs?—Yes, every thing on springs.

Do you make use of one or two cylinders?—Two.

What size?—Twelve inches in the stroke, and nine inches in the bore.

Has your Engine met with accidents?—No, except once I broke my chain; but in the course of five minutes we could replace that chain, by taking an extra chain with us.

Are your boilers easily cleaned?—In all the experience I have had with the working of boilers, I have found that they never require cleaning. I consider that the ebullition is so rapid, and the action of water so violent, that it will not allow any dirt to fix.

How long do you calculate one of your boilers would last?—It depends upon the thickness of metal. The boiler we use I consider will last, in locomotive Engines from a twelvemonth to two years.

What is the thickness of the iron that you use?—I should suppose about the eighth of an inch thick.

Of what material are they composed?—Of the best charcoal iron.

What is the appearance of your Carriage; has it an unsightly appearance?—I think my present Carriage is any way from being handsome, because it has been built entirely for experiments.

Does the chimney rise above the Carriage?—No, you cannot see the chimney.

When steam is let off, where is it let off?—You can see nothing of it.

Then there can arise no annoyance either from smoke, or from waste steam?—None at all.

Do you find that horses are frightened by your Carriage?—I think I may say safely, that not one horse in a thousand will take the least notice of it; occasionally a horse may shy at it. I have seen fine blood-horses come along, and shy at a wheelbarrow lying in the road, and not shy at my Engine. There is one very curious instance which I had once occurred, and I was obliged to the gentleman for the

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the pains he had taken. He had a fine horse on the road, and this horse shyed; he was determined to get over the difficulty, if it were possible; and to make him acquainted with it, he came with the Engine to town; and at last, when we got to London, the horse got quite tranquil, so that he put his head in the engine-house, which is very uncommon, and which is a thing I never saw a horse do before.

Then you anticipate that if such Engines become more common, there will be less difficulty in this respect?—I have no doubt of it.

Does it produce any very extraordinary noise in its motion?—We have worked so quietly latterly, that I have almost run over people on the road, and they have not heard me; I have had to halt very often, they have not been aware of the coach coming.

Under any circumstances, the noise that is anticipated would take place from the defect of the machinery, and not from the machinery itself?—Yes; we make one-third of the noise of a common stage.

When you let off steam, does it produce any violent noise in stopping?—I can give an instance to the contrary which occurred in London, which is the best place to put the thing to a test; about a fortnight or three weeks ago, Mr. Wilks was kind enough to mention my running on the Stratford road, and I wished him to present a petition from me to the House of Commons, and at the same time requested that he would take a ride with me in my Engine on the Stratford road; I waited three quarters of an hour for him, and the machinery was working the whole of the time; there were hundreds of people walking round it, and I suppose they did not know it was working at all; there was no noise at all in the machinery; and you could not, unless you had gone to the back, know that it was working.

Does spare steam pass off without noise?—Not any.

Supposing that you were going at full work, and that you had occasion to stop for a passenger, you would be obliged to let off steam?—Yes; but knowing from experience how to obviate a disadvantage of this kind, which of course practice alone has brought to bear, it is probable that a stranger would hardly know it, it is so quiet.

In what part would it be thrown off?—It is divided and thrown off from the fire in every direction, and it is instantly consumed; the force is spent.

Is not that rather a dangerous experiment, to throw a great body of steam upon a confined fire?—No, we have never found any disadvantage from it.

In no circumstances in which the Engine may be at work, have you to let off steam in a way to create a noise?—No; the boiler will not hold any quantity of steam; we let off steam from the safety valve as fast as we make it; there is no capacity for accumulation; the fault of many of the boilers is, that if any accident happens there is a complete explosion.

Then, of course, the danger is lessened?—Yes, to construct a boiler of that kind has been my object so that the steam may be let off.

Suppose if one of your boilers were to burst, what would happen?—I will give the Committee an instance. I was travelling about nine miles an hour at the time the boiler was the twenty-fourth part of an inch thick. I was working then at 100 lbs. on the square inch with 13 persons on the present vehicle that I have now in use, and all of a sudden the carriage stopped, and for what reason I was at a loss to know; I got from my stage seat and went to the Engineer to ask him what was the reason he had stopped the steam; he told me he had not stopped the Carriage, and he immediately applied his hand to the gauge cocks; I found there was neither steam nor water in the boiler. I immediately knew that the boiler was burst; they said they did not know it, as they heard no noise, and I told them that I did not mean they should know it. I said I would show them that it was so, and I took the boiler from the carriage and unscrewed it, and there were four large holes that I could put my hand into. This occurred from the chambers being too thin, and they drove all the water out of the boiler, and yet there was no injury to any person; there was not one person that heard any report; there was no steam, and there were no symptoms in any way that the machine itself had burst.

Do your boilers extend under the place where passengers sit?—No, quite at the back.

What is the length of the Carriage?—About 16 feet, and the room the boilers occupy is about three feet.

Are the chambers of the boiler placed upright side by side?—They are placed sideways.

In what circle could you turn your Carriage?—The circle of the inner wheels

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would be four feet, and the outer wheel would exceed that by the breadth between the wheels; taking the average it would be ten feet.

Supposing you wanted to turn round, what should you do?—If I got into any difficulty, and wished to go back, by applying my hand to the lever I should reverse the motions and run the reverse way.

Supposing that you are travelling in a street of ten feet wide, and that there was another street of ten feet wide branching off at right angles with the first street, would there be any difficulty in turning into it?—Not any, but I could not turn round in that street. In that case I should back the Engine.

Would you check your speed?—That would depend upon the speed I was going at. If I was going at six miles an hour, it is probable that I should not check the speed; but if I were going ten miles, it is probable that I should before I turned round into the street.

Are your fore-wheels and hind-wheels the same diameter?—The fore-wheels are three feet three, and the hind wheels are four feet.

Can you reverse the action of your Carriage with great ease?—Yes; by simply pulling a lever, it is done momentarily. In my present Carriage I could not; but I have an arrangement of that kind in the other Carriage which I am making.

Supposing you were going at the rate of eight miles an hour, and that you wished to stop suddenly, in what number of feet could you stop your Carriage?—I will say twelve feet.

Of course there is equal facility in avoiding any particular object on the road?—Yes.

In stopping so suddenly, would there not be a danger of your being thrown off?—No, I think not.

Have you ever done it?—Yes, I think I have.

Supposing that you wanted to stop in the quickest possible way, at what distance could you stop at that rate of speed?—About four feet, I should think, by backing the Engines, because it is like putting a block to the wheel.

Would there be no danger in that?—No, I think not; it would throw a strain on the Engines; the rate of eight miles an hour is not so great; it is only in extreme cases that that would be done. I am very frequently obliged to pull up very short, from children running in the road.

Of what materials are your wheels made?—Like common dished wheels, they ought to be perfectly cylindrical. I merely took them to avoid expense; they were wheels which I had by me.

Are you proprietor of any other coaches?—No.

Have you any means of ascertaining the proportion of friction that there is on your wheels, and those drawn by horses?—No, I have never gone into experiments to any extent upon that point.

Are your wheels shod frequently?—No, I have never had occasion to have the wheels shod, they were not worn out.

For what number of miles could you run without being obliged to shoe your wheels?—I do not know.

Do you find any difference of wear between your propelling wheels and your drawing wheels?—No, except in relation to the weight on the hind-wheels. We throw more weight in order to produce friction, to get adhesion to the ground.

Have you any scheme of tolls to produce to the Committee, which you think would be equitable to lay on Steam Carriages, for the use of the road?—I have considered the thing a great deal, and after taking every thing into consideration, the weight of the Engine and the weight of the boiler, and so on, on the one hand, I think it is much upon a par with the weight of the horses, and the weight of the coach and the weight of the passengers, on the other.

What would you consider the most equitable mode of charging Steam Carriages?—I think there can be no better mode than charging them as other coaches are charged.

Supposing that a common coach at present takes eighteen persons, and you, by improvement of your coaches, could take thirty-six persons, how would you apportion the rate of tolls that you ought to pay?—In that case, I think the fairest way would be to have it in proportion to the number of persons that are carried.

Do you think it should be charged by weight?—That, perhaps, would be as fair a way as any of charging the toll.

Charging the weight of your Engine as compared with the weight of common coaches?—Yes.

Have

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Have you turned your attention to the improvement of your machine, by affixing a Carriage to it, and making your Engine independent of the Carriage?—Yes; I have considered the thing well in every point, and I think it is much better to construct the Carriage both for passengers and machinery on one arrangement, not to have the thing divided: my reason for considering it an improvement is this; for instance, if a new road is made, the object of the proprietors of that road is to get as heavy a roller as they can, even if it requires eight horses to draw the roller; they do that in order to imbed the gravel to make it solid, and the nearer that Steam Coach approaches that roller, the better it is for the propelling wheels.

With respect to the tolls, are you satisfied with the present tolls you pay?—I think they are exorbitant; from Islington to the City Road they charge me a shilling.

Are you aware what four-horse coaches, with eighteen passengers, pay on the same road?—I am not aware.

From what cause do you judge it excessive?—From the short distance which I come; I do not know what length of road I should have had to run before I should have been subject to another toll.

Have you considered the subject whether it would be more equitable to charge the Steam Carriages by horse-power or by weight, or by the number of passengers?—I think the fairest way would be in proportion to the number of persons they carried, or in proportion to the weight.

What would you give as the basis of your calculation, considering that the number of persons which the different coaches carry varies from eight to eighteen?—I see no other way, excepting that of the number of passengers, or according to the weight.

Have you made any calculation as to the number of horses that the extension of these Carriages will displace with respect to each stage; what horse-power is equivalent to the Carriage that you run?—I take a stage to run 100 miles a day, and I reckon upon the average it would take from 48 to 50 horses for the whole distance; the common average is a horse a mile; but from the information I have endeavoured to get, from what I have gathered, I find it is about 48 or 50; I believe it is to be taken backwards and forwards at a horse a mile.

Would your Carriage displace along the road four horses on each stage?—Two ten-horse Engines would displace the whole number of horses along the stage.

Have you made experiments which enable you to answer these questions?—I was not at all prepared; my principal object has been to ascertain what power I have to do a certain work; I have paid very little attention to horse power.

Do you think that your Carriage is equivalent to a four-horse Carriage on the road, in the number of persons it would draw?—It is more than equivalent to it, from the circumstance of its being able to do more work.

Supposing you have to run seven miles, how many passengers could you carry at your present speed?—Fourteen.

Supposing that a coach of four horses were to run that seven miles, how many passengers would it take?—It would carry the same number.

What weight, upon a dead level, will set your Carriage in motion on the road if you were to attach a rope to the pole, and suspend that rope over a pulley, and attach a weight to it, what weight will set your Carriage in motion?—It is an experiment I have never tried, and I am not prepared to answer.

Do you know what, if you were to set your Carriage on an inclined plane, is the inclination that will set it moving?—No, that is not a thing which I have tried.

Do all the wheels follow in the same track?—Yes, they do.

Have you ever tried your Carriage up hill on an inclination?—Yes, I have, repeatedly.

Do you find an increased difficulty in proportion to the length of the inclination?—No, we go much slower; but we never find any difficulty.

Have you ever found your wheels slip?—No, excepting once on the City Road, at the time when the frost was on the road; it was quite slippery; and then, for an experiment, I tried to see if I could run up the Pentonville Hill with one wheel only, and I did, but it was with some difficulty towards the top; if I had propelled by the two wheels, there would have been none.

Have you found at what inclination in a frost the wheels will begin to turn?—I never witnessed such a thing.

Are you aware that such a thing will occur?—Yes; but I think there are no hills which are to be found, upon which horses travel, but what a coach would propel itself up.

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Have you ever seen your Carriage get into a deep rut?—Yes.

In such a case what generally happens?—If it is a single wheel, it may go round two or three times; if I have two wheels, it is improbable I should get into such a situation.

Do you find peculiar states of the roads upon which you travel, more disadvantageous than others to the progress of your Carriage?—Yes.

Which do you find the most disadvantageous?—When the roads are between wet and dry.

In going down a hill, are you obliged to lock your wheel in any way?—Yes, if it is much down hill; it depends upon its inclination.

What is the nature of the provision for locking the wheel?—A metallic band, bearing upon the outer part of the wheel.

What are the fares that you take, higher or lower than ordinary stages?—They are the same fares as the stage fares, eight-pence from Bow, and nine-pence from Stratford.

How much is that a mile?—Barely two-pence a mile.

In what proportion to what is charged by stage coaches do you think you should be able to charge your fares?—I think the fares would be reduced to two-thirds, after a short time, if supported and not over burthened by tolls.

Should you be able to continue running if the fares were reduced to two-thirds?—Yes.

In your present state of knowledge upon this subject, in what proportion do you think the rate of travelling would be diminished?—In the proportion I have stated of two-thirds.

Is it your opinion, that, generally speaking, it would be reduced two-thirds?—Not in the outset, but after the thing has had full play.

Have you made any calculation of the expense of running a coach drawn by four horses, carrying a certain number of passengers, and that of running with one of your Carriages at the same velocity?—I have endeavoured several times, but I have never been able to get an accurate account of the power and other expenses incurred in driving a long stage; but I reckon my own expenses will cost from three to four pounds a day, including all expenses attached to the coach, wages for engineer, steersman, fuel, oil, &c.

What expense is it a mile upon your coach?—I have taken the one hundred miles, and included the day's expenses.

Were you ever a stage proprietor yourself?—No.

Then from your own knowledge you can state nothing as to the cost of carrying passengers by a stage coach?—No.

Could you, if you were to travel one hundred miles in ten hours, keep up that rate without damage to the machine?—Yes, I reckon the work would be done in eight hours, but the stoppages and one thing and another will take up two hours.

Mercurii, 10^o die Augusti, 1831.

John Farey, Esquire, called in; and Examined.

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HAVE the goodness to state your profession?—I am an Engineer.

How long have you been so?—It is twenty-five years since I began my studies; I have been much employed by inventors, to assist them in bringing forward new inventions of a mechanical nature, and in establishing them as practical businesses, when they have been sufficiently perfect to admit of so doing.

Have you turned your attention to the subject of propelling Stage Coaches or other Carriages by Steam Power on common roads, instead of by horses?—I have had occasion to prepare specifications of several such inventions for which Patents have been taken out, and have in consequence paid a close attention to that subject; I have also been consulted to settle the plans for the practical execution of Steam Coaches, but I have not directed or superintended any such execution myself. Of the specifications I have prepared, three have been followed up by building Coaches, which have actually travelled on common roads; viz. Mr. Gurney's, Mr. Hancock's, and Messrs. Heaton's; I believe those three are the only trials amongst many others which have had so much success as to have been persisted in to the present time. I have examined other Steam Coaches, but they had no chance of success, and have been abandoned.

Will

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Will you state generally your opinion as to the probability of this mode of propelling Carriages superseding the necessity of using horses?—All that has been hitherto done, or which is now doing, in that way, must, I think, be considered as experimental trials. I have no doubt whatever but that a steady perseverance in such trials will lead to the general adoption of Steam Coaches, and that at an earlier or later period, according to the activity and intelligence with which an experimental course is conducted; and I am firmly convinced that the perfection which is essential to their successful adoption will never be attained by any other course than that of reiterated trials. The difficulties with which the Steam Coach inventors are at present contending are chiefly of a practical nature, which, I think, are not likely to be avoided by any great efforts of genius or invention; but I expect that they may be surmounted one after another by the experience which may be gained by competent mechanics in a course of practice. I do not look for much more invention as necessary to the establishment of Steam Coaches; but it is certain that the practice is indispensable. Each of the three inventors I have named has brought his Steam Coach to that state which renders it a full-sized model for making such experiments as serve to prove the principle of action, and to teach how a better Coach may be made the next time, but nothing more. The probability that such next better coach will be sufficiently perfect to answer as a trading business, depends as much upon the natural judgment and acquired skill of each inventor, as upon the qualifications of his present production.

Has the experience which has already been had of Steam Carriages been such as to enable us to say that it is not merely in theory we have calculated on these Carriages?—Yes; what has been done by the above-mentioned inventors, proves to my satisfaction the practicability of impelling Stage Coaches by Steam on good common roads, in tolerable level parts of the country, without horses, at a speed of eight or ten miles an hour. The Steam Coaches I have tried, have made very good progress along the road, but have been very deficient in strength, and consequently in permanency of keeping in repair, also in accommodation for passengers and for luggage; for which reasons they are none of them models to proceed upon to build Coaches as matter of business. From the complexity of their structures and the multiplicity of pieces of which they are composed, it is impracticable to give them the requisite strength by mere addition of materials, because they would then be too heavy to carry profitable loads as stage coaches. I do not consider that it is now a question of theory, for the practicability I conceive to be proved; but many details of execution, which are necessary to a successful practice, are yet in a very imperfect state. My view of the subject will be best understood by stating, that I believe an efficient Steam Carriage might now be made merely to carry despatches, by following the general plan of the best Steam Coach which has yet been produced, improving the proportions wherever experience has shown them to be faulty, using the very best workmanship and materials, and giving a judicious increase of strength to the various parts which require it, allowing all the weight of a load of passengers and luggage, and of the accommodations for them, in additional strength of materials, so that the total weight of the Coach, without any passengers or goods (beyond the people and stores necessary for its own use and one courier), should be as much as the weight of the previous model containing a full load of passengers and luggage. If three such Coaches were constructed, one of them might start every morning at each end of any fair line of road 100 or 120 miles long, and one would arrive every evening at each end of that line in less time than a common stage coach; and I should expect that, after twelve months' perseverance, and after making all the improvements and alterations in the machinery which so much experience would suggest, the double passage ought to be made with as much safety and punctuality, and with much more expedition, than by the mail. The road between London and Bristol might be taken as a suitable line, but I should expect a pair of horses to be provided at every notable hill, to help the Steam Carriage up it. Such a proposition, it is obvious, offers no inducement to individuals, because it would be all expense without any return; but if it were judiciously done at public expense, I have no doubt but that it would lead to as much improvement in the mode of execution of future Coaches as would enable them to be run permanently as stage coaches with profitable loads. The great defect of all the present models, is want of strength to resist the violence to which they are subjected in rapid travelling with a full load; and if that strength were given upon the present construction by the mere addition of materials, they would become too heavy to be efficiently propelled, even if they carried no load in them.

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Have you seen the last Coaches of Mr. Gurney and of Mr. Hancock?—I have not minutely examined the last edition of Mr. Gurney's Carriage, but have met it several times on the roads in my neighbourhood, as I have also that of Mr. Hancock; and I have travelled in the latter; but he has enlarged the cylinders of his engine since I have gone in it.

You have seen Mr. Gurney's original boilers; he states that he has altered very little in the form of them?—Yes; I was well acquainted with the construction and performance of all that Mr. Gurney had attained at the time when I specified his patent, three years ago; and I understand generally the alterations he has since made, though I have not made trial of any of his more recent Coaches; the principal change is in separating the engine and machinery from the Carriage which is to convey the passengers, so that there are two four-wheeled carriages, one drawing the other after it; this change involves no very great alteration in the machinery, which, I understand, is nearly the same as it was; but the impelling Carriage in which it is placed is very much lightened by transferring all the passengers to the additional Carriage which is drawn. Mr. Hancock continues to follow the original plan of carrying the passengers in the same four-wheeled Carriage with the engine.

As far as your experience has gone, which plan of Steam Carriage do you think will hereafter be most generally resorted to, that of an Engine Carriage, drawing after it another Carriage containing the passengers, or of conveying the passengers in the Carriage in which the machinery is placed?—I have not had experience in drawing by two Carriages, except by the analogy of what is done on railways, and hence I feel some difficulty in speaking positively upon that point; there are advantages and disadvantages to be considered in both modes, but all the mechanical considerations incline to one side, viz. to place the engines in the same Carriage with the passengers; that plan will certainly be lighter than when two separate Carriages are used, and also the weight will be laid on those wheels which are turned by the engines, as it should be, to give them a firmer adherence to the road; also one Carriage will steer and turn much better than two, and will go safer down hill, and will be cheaper to build and to work.

By that means great weight is saved?—Yes; perhaps one-third is saved in exerting an equal power. In stating my opinion of the probability of a profitable result, after twelve months' trial of three coaches to run regularly two hundred miles every day, with dispatches only, I contemplated that the engines and passengers would be ultimately in one Carriage, because that plan has a most decided mechanical advantage in making progress along the road, and also in facility of steerage, and safety in going down hill, and fewer servants are required to manage one Carriage than two. On the other hand, all the constructions that have yet been tried with one Carriage, subject the passengers to more or less occasional annoyance from heat and noise, smoke and dust, and there is still an apprehension of danger from the boiler, hence passengers will invariably prefer to go in a separate Carriage to be drawn by the Engine-carriage; that mode also offers a facility of changing the engine for another, or for post horses, in case it gets deranged, because the change may be made without unloading, and discomposing the passengers; for common stage coaches these are strong motives to use a separate Carriage, and if it can be brought to bear in comparison with horses, that mode will probably be most generally adopted by the influence of the passengers, although the other mode will inevitably perform the best and attain the greatest speed of travelling.

Taking the two machines of Mr. Gurney and Mr. Hancock in their present state, do you think them entirely free from defects likely to prove dangerous to travellers?—I do not think the danger is at all considerable in either Mr. Gurney's or Mr. Hancock's; there are dangers in all travelling; but I do not think the amount of danger will be at all increased by substituting steam for horses, according to either of those plans.

The question refers to the peculiar danger from the nature of the propelling power?—I am not inclined to think that there is any peculiar danger which would be incurred by the change; and if the engines and passengers are not on the same Carriage, I think the ordinary danger would on the whole be diminished.

The question is with reference to the relative danger of travelling ten miles an hour when drawn by horses, and when propelled by steam at the same rate?—The danger of being run away with and overturned is greatly diminished in a steam coach. It is very difficult to control four such horses as can draw a heavy stage coach ten miles an hour in case they are frightened, or choose to run away, and for such quick travelling they must be kept in that state of courage that they are
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always inclined for running away, particularly down hill, and at sharp turns in the road. The steam power has very little corresponding danger, being perfectly controllable, and capable of exerting its power in reverse, to retard in going down hill; it must be carelessness that would occasion the overturning of a Steam Carriage, which carries the passengers in the same Carriage with the engines. The distinct Carriage I consider to be much less controllable, in turning corners and going down hill, but yet far more so than horses. The chance of breaking down has hitherto been considerable, but it will not be more than usual in stage coaches, when the work is truly proportioned and properly executed. The risk of explosion of the boilers is the only new cause of danger, and that I consider not equivalent to the danger from the horses. There have been, for several years past, a number of locomotive engines in constant use on railways, all of them having large high pressure boilers, very much more dangerous than Mr. Gurney's or Mr. Hancock's, whether we consider the probability of explosion, or the consequences likely to follow an explosion, because being of large diameters they are less capable of sustaining the internal pressure of the steam, and also they contain a large stock of confined steam and hot water. The instances of explosion among those locomotive engines have been very rare indeed.

Have you seen Mr. Hancock's last improvement?—Yes; I consider Mr. Hancock's boiler to be much better for Steam Coaches than any other which has been proposed or tried.

If that boiler were to explode it is understood that there would be no danger at all?—It is very difficult to foresee that; at the same time the risk of explosion in Mr. Hancock's boiler is certainly very much less than in the locomotive boilers, which are in constant use on a large scale on railways, and where we have proof that the extent of the danger is very small.

Do you think his boiler might explode without the passengers knowing any thing about it?—The metal plates of which the boiler is composed will burn through by the continuance of the action of the fire, and may crack or open so as to let the steam or water out of the boiler and disable the coach from proceeding, but that is hardly to be called an explosion; no one would be hurt; the crack which lets out the hot water is sure to throw it into the fire in that case, and not on the passengers.

You consider the danger to passengers by the chance of bursting of a boiler as not equivalent to the danger of horses running away?—It is not equivalent in my opinion, the probability of a coach being overturned by the horses is far greater than that of a boiler bursting, and when either accident does occur, the probable extent of mischief from an overturn in which all the passengers must participate, is much greater than could be expected from the bursting of a boiler, which must always be kept at a considerable distance from the passengers on account of the heat.

Supposing either Mr. Hancock's or Mr. Gurney's boiler were to burst; in the one case the boiler being in a separate Carriage, and in the other, the boiler being at a considerable distance behind the passengers, what danger do you think could arise to the passengers from the bursting of the boiler?—There is very little difference between the two cases; the separate Carriage obviates any apprehension that passengers could entertain from the danger of explosion, and will therefore be preferred by most passengers, but for myself I do not rate that risk so high as to be induced to encounter the complexity of the two Carriages, and to forego some of that new security which steam power offers by its controllability in descending hills and turning corners, compared with horses; and in which circumstance, as I have before stated, I think the plan of one Carriage is much to be preferred, and probably the other objections of heat and noise and dust may be overcome by some new means, which have not yet been shown; in Mr. Hancock's Carriage the boiler is quite behind, and away from the passengers, so that they are out of danger, if there is any, and are not materially annoyed by heat or smoke and dust, except at times when the wind brings it forwards, and that rarely happens when the Coach is moving.

Is not the danger attendant on the bursting the boiler greatly diminished by the subdivision of its internal capacity into tubes or small and flattened chambers?—Unquestionably, until the danger of explosion has become exceedingly small; but the great difficulty of boilers for Steam Coaches is, that the liability to burn through the plates has been increased by that expedient for ensuring safety; and the progress of the invention has been impeded between those two difficulties in a

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greater degree than from any other circumstance. It was a desideratum for a long time to contrive a boiler, which being made of such thin metal as would not render it too heavy, should have sufficient strength to retain high pressure steam without danger of bursting; also that it should expose a sufficient external surface of metal to the fire and flame, and of internal surface to the contained water, to enable the required quantity of steam to be produced from such a small body of water as could be carried on account of the weight, both these conditions were fulfilled by subdividing the contained water into small tubes or into flat chambers, which expose a great surface in proportion to their internal capacity, and admit of being made strong with thin metal; but there is also another condition which is rather incompatible with the two former; viz. that there shall be such a very free communication between the interior capacities of all the tubes or narrow spaces, as will combine them all into one capacity, and permit the contained water to run from one to another, and also permit the steam, which is generated in innumerable small bubbles within the narrow spaces, to get freely away from them, to go to the engines without accumulating and collecting into such large bubbles as would occupy the spaces and displace or drive out the water before them; for if that effect takes place it produces three great evils; the water boils over into the engines along with the steam and is wasted, and the thin metal which remains exposed at the outside to the fire, becomes burning hot in an instant, after the water is so driven away from the internal surface, and the further production of steam is suspended, so long as the water continues absent. If such displacement of the water takes place frequently, and in many of the narrow spaces at once, the boiler will not produce its proper quantity of steam, and the thin metal will soon be destroyed by the fire and burned through.

Have you seen Mr. Hancock's boiler?—Yes; I have had many trials of it; and I am well acquainted with Mr. Gurney's; the former uses flat chambers of thin iron plate standing edgeways upwards over the fire in parallel vertical planes; the latter uses small tubes (such as gun barrels are made of,) to contain the water, the fire being applied on the outsides of the tubes. In Mr. Gurney's boiler I think the subdivision of the water into small spaces is carried too far, because the steam cannot get freely away, out of such small tubes as he uses (and they are also of great length) without displacing much of water which ought always to be contained within them. By an ingenious arrangement of connecting pipes and vessels which he called Separators, he collects all the water which is so displaced along with the steam, and returns it again into the lower ends of the same tubes, and thus avoids the evil of water boiling over into the engines; but that makes only a partial remedy for the diminished production of steam, which is attendant on the absence of the water from the heated tubes, and the still greater mischief of burning and destroying the metal. Hence the evil of burning out the tubes is very great. Also his separators hold a considerable weight of water, from which no steam is generated; and they require to be heavy in metal, to render them quite safe and strong. Mr. Hancock has taken the middle course in subdividing the water in his boiler, having all that can be required for safety, and the weight I believe, on the whole, to be less than that of any other boiler which will produce the same power of steam; for, owing to the freedom with which the steam can get away in bubbles from the water without carrying water with it, the surface of the heated metal is never left without water. Hence a greater effect of boiling is attained from a given surface of metal and body of contained water, and that with a much greater durability of the metal plates, than I think will ever be obtained with small tubes.

Do you think there is a danger of such an explosion as could do injury from the mode in which Mr. Hancock's boilers are constructed?—That danger I hold to be very slight; the metal of Mr. Hancock's chambers will burn through in time, the same as that of Mr. Gurney's tubes will do, but not so soon; I think, taking the thickness of metal to be the same in both cases, no injury will be done by such burning through. The flat chambers in Mr. Hancock's boiler are very judiciously combined, and are secured against bursting by causing the pressure which tends to burst each one open, to be counteracted by the corresponding pressure of the neighbouring chamber; and the outside chambers are secured by six bolts of prodigious strength, which pass through all the chambers, and unite them all together so firmly that I see no probability of an explosion. Mr. Gurney's vessels, called Separators, are secured by hoops round them, and being of a small size, may be made very safe. Hence I think the two boilers may be put on a par as to their security; but there is a decided preference in my opinion of Mr. Hancock's form of subdividing the

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the water and steam compartments, which I believe is carried too far in Mr. Gurney's tubes whereby the water, included within the several tubes, cannot make way to allow the bubbles of steam to pass by it. This is owing to the great length and the small bore of the tubes; and they are so isolated one from another, that the water within them is not able to act as a common stock of water, or to keep all the interior surfaces of the metal tubes thoroughly supplied with water: thence there is a deficient production of steam and an unnecessary destruction of metal.

Are you aware that, in Mr. Hancock's Carriage, the waste steam which is discharged from the engines after having performed its office, is thrown into the fire-place, and makes its escape upwards along with the flame, smoke and heated air, and gas, which ascend from the fire to act on the boiler?—That is the way in which he gets rid of the waste steam which the engines discharge, and I understand that he thereby avoids the puffing noise and appearance of steam which is common with high-pressure engines. Mr. Hancock blows the fire with a current of air, produced by a revolving fanner, which is turned rapidly round by the engines, and therefore he requires no tall chimney to produce a draft. Mr. Gurney formerly used a singular fanner to blow the fire, and also a chimney of some height; but I understand he has lately laid it aside, and adopted the plan of carrying the waste Steam which has passed through the engines into the bottom of the upright chimney, and there discharging that steam through a contracted orifice in a vertical jet, which, by rising upwards with great velocity in the centre of the chimney tube, gives a vast increase to the draft of heated air and smoke in the chimney tube, without any great height being necessary; and this plan occasions a most active current of fresh air to pass up through the fire, and urge the combustion. This is a most important improvement in locomotive Engines, which has been introduced by Mr. Stephenson into his Engines on the Liverpool and Manchester Railway, and being there combined with an improved boiler, it has been one of the great causes of the brilliant success of that undertaking. I believe the same plan will be indispensable to the complete success of Steam Carriages; for chimnies cannot be used high enough to obtain a draft, and blowing the fire is a very troublesome affair. I fear Mr. Stephenson's plan would occasion more noise than is allowable on common roads; but that may perhaps be avoided or diminished by some new expedient.

Do you think any danger would arise from the waste steam being discharged over a large mass of fire on Mr. Hancock's plan?—Not the least danger; all the waste steam which blows off at the safety-valve, and which the engines do not require, is got rid of in the same way; but I expect Mr. Hancock does not help the combustion of the fuel by thus mixing the waste steam with the flame before it acts against the boiler. Mr. Stephenson's improvement, which Mr. Gurney has adopted, is to discharge all the waste steam into the bottom of the upright chimney with a violent vertical jet, in order to accelerate the draft up the chimney. The waste steam, therefore, is mixed with the smoke and gas, after the smoke has ceased to act on the boiler. The waste steam was very commonly discharged into the bottom of the chimney, in Trevethick's high pressure engines, many years ago, in order to mix with the smoke ascending in the chimney, and thus get rid of the waste steam; it improved the draft in that way, by rendering the smoke more buoyant, but only in a slight degree; but the waste steam was not discharged through a contracted orifice to give it velocity, nor was it directed upwards as is now done by Mr. Stephenson; and that vertical jet of steam in the centre of the chimney, gives such an intensity of draft through the fire as was never procured before, and with the further advantage that the rapidity of draft so produced, increases whenever the engines work faster, and discharge more steam, just in proportion as the demand for fire and steam increases by that working faster.

Is there any noise occasioned in that way?—Yes; but the sound is directed upwards by the chimney, and is not much heard in the locomotive Engines on the railway when they are in the open air, but when they pass under the bridges, the sound is reverberated down again by the arch, and then it sounds very loud. The noise is no great consequence there, and no particular pains have been taken to avoid it. The metal pipe of the chimney has something of the effect of an organ-pipe or trumpet, but it is probable the sound might be deadened.

Will the burning out of the plates of Mr. Hancock's boiler, that you spoke of, be attended with risk of explosion of the whole boiler, or only of the smaller divisions of the boiler?—It will be attended with no violence which could be called an explosion, nor with any danger whatever, but only with the inconvenience of dis-

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abling the Carriage until the ruptured chamber is replaced by another. The rupture or crack of the metal plate at the burned place, would let out the water and steam very gradually into the fire, and probably extinguish it. All steam boilers burn out in that manner sooner or later. The different chambers of Mr. Hancock's boiler are kept together by six very strong bolts, which pass through them all, and which are quite protected from the action of the fire; to burst the boiler those bolts must give way altogether, and there is no adequate force to produce any such effect.

Are you acquainted with the construction of the new Steam Carriage which started this week from Gloucester to Cheltenham?—I am not, further than that it is on Mr. Gurney's plan.

Apprehension has been felt that these Steam Coaches will be found to give great annoyance to travellers passing them on the public roads, from smoke and the peculiar noise from letting off the steam; do you apprehend such results will take place?—I do not anticipate any great annoyance will result to travellers in other carriages; I have passed Mr. Hancock's on the road several times and Mr. Gurney's also, and have travelled in them often; horses take a little notice of them when in motion, but not much, and very soon become accustomed to them. I once met Mr. Hancock going very quick along the New Road, and drew up to see him pass; I had no difficulty whatever in making my poney stand, though rather a spirited one. Mr. Hancock did not observe me, and as I wished to go with him I turned and drove after him, and after a race to overtake him, I had no difficulty in drawing alongside of his Steam Carriage for a good way in order to speak to him and get him to stop for me. The emission of hot air was very sensible, when following close along side of the boiler, at the hinder end of the Carriage, but I did not observe any puffing of steam.

Do you think that whatever annoyance exists in the present Steam Coaches may be removed by the improvement of the Carriage, and particularly the appearance of the Carriage?—Certainly their appearance may be improved; they are most unsightly now. The general question of farther improvements in Steam Coaches depends upon the general mechanical skill and judgment of the mechanics who turn their attention to the subject, and the peculiar experience they acquire in this particular branch of mechanics, by continually practising and exercising with Steam Carriages, on roads of all kinds, in all weathers, to find out their defects, and how to remedy them; and what is the best mode of management; also by building new and better Carriages as soon as they have learned what will be better than the present ones. But all this must be at a great pecuniary loss, and some further encouragement must be held out in order to induce the more skilful mechanics to embark in such a pursuit; for at present it is by no means an object of attention to our best and most competent engineers, because they know they would only throw away their money and time by undertaking Steam Coaches, even if they were to succeed ever so completely. The Patentees are a different class of men; they are the inventors, who have first organized and arranged the combination of machinery which is to be used; and, according to law, they have acquired a legal property in those peculiar combinations which they have discovered, that has been their encouragement and stimulus to exertion; but the terms of their patent rights will be very likely to expire before their inventions come into use to such an extent as will repay them their previous costs with any profit thereon; and also, with the present defective state of the law on the subject of patents, they will be unusually lucky if they are able to make good their patents at law, in case their rights are contested. The Patentees are not experienced mechanics or engineers, and have had to learn the business of engine-making and of coach-making as they went on; and a great deal of the deficiency of the present Steam Coaches has arisen from the circumstance, that they have been made by persons who were not at that time qualified to execute either a common coach or a common Steam Engine; but they have acquired more skill now, and we may expect more finished productions from them in future. There is no mechanic, of the class of those who will be ultimately employed to make the engines and machinery of Steam Coaches when they do come into use (and who alone can give that perfection of design, proportion and execution which is essential to their coming into use), who will have any thing to do with them now; not so much from any doubts that they would not be able to succeed in perfecting them, as from a conviction that the expense of attaining success would be greater than would be repaid by any advantage they could afterwards derive from making such machines, in open competition with every other mechanic who chose to copy after their model when perfected; for that perfection of design, proportion and execution in which

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which Steam Coaches are now wanting, though very laborious and expensive of attainment, would not be grounds for exclusive privileges under the existing law of patents. The patents to the first inventors are the only ones which are professed to be recognized by law, though in effect they can scarcely ever be maintained at law. That is a very important point for the consideration of the Committee, and one which deserves great attention. As the law of property in inventions now stands, when a new invention is advanced to such a stage that it may be considered to be tolerably perfect as an invention, no further exclusive privilege can be maintained to compensate for the skill, labour and expense which must be incurred to find out true proportions, dimensions, weights and strength which are essential to bring it to bear as a practical business. The law professes to give the whole to the first inventor, although he may have only laid the foundation on which another has raised the superstructure; and if, as usually happens, the claim of the first inventor is set aside, from technical informality in his title-deeds, and also when his term expires, the whole superstructure lapses to the public. For these reasons, those who are the most competent to the task of giving the finishing touches of practical utility to great inventions, are kept back by being aware that they shall not be repaid. Under such circumstances, a defect of judgment would be proved *à priori* against any one who might commence such an unpromising pursuit, and that want of judgment which could permit a man to overlook the pecuniary considerations, would not be favourable to his success as a mechanic, in giving that precision of form and dimensions, and that practical utility, to an invention which requires an exercise of the cool judgment resulting from experience, rather than of the genius depending upon original thought.

You do not consider the inconveniences of the present Steam Coaches to be inseparable from the invention?—Certainly not; but I do not think that any of the individuals at present engaged in the pursuit are the most competent persons who could be chosen to overcome the remaining difficulties, being inventors, who have almost completed their parts of the task, and not experienced practical engineers, into whose hands the affair of building the next Steam Coaches ought now to pass, under the general direction and advice of those inventors; if the building of Steam Coaches is continued in their hands, they will only advance towards perfection of proportion and execution by slow degrees, as the Patentees acquire that general skill as engineers and mechanists which is already possessed by professional engineers.

You think that the machinery may be improved by better mechanists?—I have not the least doubt of it; and yet those mechanists are not the proper men of genius to have invented what has been hitherto done by the Patentees.

Apprehensions have been felt by trustees and surveyors of roads that Steam Carriages are more injurious to the roads than Carriages of equal weights drawn by horses; what is your opinion upon that point?—I should not apprehend that the present Coaches are injurious in a greater degree than other Carriages of equal weights; and when Steam Coaches are really brought to bear, I think they will be much less so than any Carriage at present in use, taking horses and the Carriage they draw against Engines and the Carriage they impel, at weight for weight. All my observation upon Steam Carriages has led me to believe that they do no particular harm to the road; I could never perceive any peculiar marks that they left in their tracks, and an examination of the iron tire on the edges of the wheels of Mr. Hancock's Carriage shows evidently that no slipping takes place on the surface of the road; and that fact is proved to a certainty by other observations on the working of that Carriage. It will be a long time before a sufficient number of Steam Carriages travel over any road to bring their effect on the materials to the test of experience; but on general principles I have no hesitation whatever in stating my opinion, that they never will answer as long as they do injure the roads any more than the fair wear occasioned by the wheels of other Carriages of the same weight; for any injury they might do to the road must be by a slipping of their wheels on the road, which would be a waste of the power of their Engines, and hitherto they have had no power to spare; or, if their wheels are too narrow, and they cut deep into the road, the power of the Engines will be wasted. If they are to be efficiently advanced, the whole power must be fairly exerted in advancing them forwards along the road, without turning their wheels in vain on the road, or cutting ruts in the road. I am confident that, if the wheels slip at all on the roads so as to lose motion, or if they penetrate so as to make ruts, those Coaches will not answer, and the defects must be remedied, or the Coaches must be given up. I do not mean to affirm whether the present Steam Coaches which draw other Carriages after them do

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or do not slip on the road, because I have not examined them; but I am of opinion that for the ultimate successful application of steam power, the Carriages must be so constructed that they will do less injury to the roads than Carriages drawn by horses; and whenever Steam Coaches become common, I think the roads will be most materially benefited by the change.

Supposing the total weight of a stage or mail coach, drawn by four horses at ten miles an hour, to be two tons, and the weight of the four horses to be two tons, what proportion of the wear of a Macadam road would you expect to be occasioned by the wheels of the coach, supposing them to be the usual breadth of stage coach wheels, and what would be the wear by the horse's feet?—It is impossible to fix an accurate proportion for such a question as that; but I have no doubt but that, weight for weight, horses' feet do far more injury to a road than the wheels of a carriage, and particularly so at quick speeds, because wheels have a rolling action on the materials of the road, tending to consolidate, and the horses' feet have a scraping and digging action, tending to tear up the materials. One test of the wear by horses' feet will be in the wear of towing-paths for canals, and the railway roads where horses are employed; in either of those cases, the number of horses which pass along is so small, that no turnpike roads afford any example of comparison, and yet the wear of towing and railway paths is found to be considerable. The rapid wear of horses' shoes is another test.

It has been stated by a previous witness, that the proportion of the wear of a Macadam road, under such circumstances, would be about two-thirds by the horses, and one-third by the carriage; should you think that a fair approximation to the truth?—I have no means of judging with such precision, but I have no doubt whatever that, in the case above supposed, the wear by the horses' feet would be much greater than the wear by the wheels; for independently of the difference of the action, as before stated, the rapidity of the blows wherewith the horses strike down their feet, in stepping quickly, wears the road, and they keep their feet pressing on the same spot for a sensible time afterwards, which must have a far greater effect on the materials, to wear and loosen them, than the comparatively progressive rolling of the wheels over the road, because the latter remain only an imperceptibly short space of time on the same spot, and have a consolidating action.

May you take the wear of horses' shoes, in proportion to that of the tire of the wheels, as a fair test of the proportionate wear of the road by each?—No, by no means, because the pressure which the wheels exert, and which wears away the tire, is, under certain conditions, very beneficial to the road; whereas the pressure occasioned by the horses' feet is in all cases pernicious. On a gravelled road, which is not yet consolidated, the rolling action which causes the wear of the tire of wheels produces a great improvement of the road, when the treading action, which causes an equal wear of horses' shoes, does nothing but mischief. The harder and more solid the road becomes, the less this may be apparent, because the wear of the road becomes so imperceptible; nevertheless, I think the proportion of less wear by wheels than by horses' shoes, will still hold true.

What is the average width of the tire of the wheels of Steam Carriages you have tried?—Mr. Hancock's wheels are two inches and three inches broad; in Mr. Gurney's Carriage, when he carried the load along with the engines, the wheels were two inches and a half broad; but I understand he has widened them since he has altered his system of drawing a separate Carriage, which is to be expected as a necessary consequence of the alteration.

Do you think the machine would act with less advantage if the wheels were wider?—That depends entirely upon the weight resting upon the wheels, and the sort of roads they are to run upon. I think it would be better for those individual Carriages to use broader wheels than they had.

If the tire of Mr. Hancock's were six inches broad, would it be an advantage or a disadvantage?—I think six inches would be too wide for that description of Carriage; about four inches I should think a suitable width for his wheels. Mr. Hancock's Carriage is so arranged, that a greater proportion of the whole weight of the Carriage is thrown upon the hinder wheels, to one or both of which the power of the engines is applied, than upon the fore wheels: that I think is very judicious, because it ensures such an effectual adhesion of the hind wheels to the road that no slipping can take place. The breadth of the wheels must be so proportioned to the pressure that they exert on the road, that they will not indent or press in, to leave deep marks behind them. The actual breadth that will be suitable to any given weight will depend upon the hardness of the materials of which the road is made, and

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roads differ very much in that respect; I think that in all cases the breadth of wheels which will enable the Carriage to make the best progress, will be that which will do the least injury to the road, for it will be that which will occasion no disturbance of the stones after they have been consolidated, but will only wear away their upper surfaces, and the iron of the tire.

You have stated that you think the bringing of these machines to perfection is retarded, because there is not a sufficient prospect of encouragement, and that Steam Coaches are therefore confined to the hands of persons who have not the same skill in practical mechanics as others, who would undertake the subject if adequate encouragement were offered; can you point out any mode by which that encouragement could be given?—Nothing could do it so effectually as offering a handsome Parliamentary reward for the attainment of some specified performance, such as keeping a Steam Coach for passengers regularly plying on some suitable road for two years, during which it should not have failed to arrive by steam more than some specified number of times, and within a certain number of hours of lost time from the time-bill of the Mail on the same road. Suppose this were done between London and Bristol, for a reward of 10,000*l.* it would cost the public nothing if it were not accomplished, and the establishment of that one Coach to carry the Mail would be worth the money to the public whenever it was accomplished; or between London and Holyhead would be still more important, but that would require 20,000*l.* reward. Another plan of more immediate application would be to offer a bounty of a fair price per mile for carrying despatches by steam (as I suggested before) whenever they arrived in a specified time; the price should be sufficient to pay expenses. That would, I think, be the best course, because I believe it would be undertaken at once by individuals, provided that no stipulations were made either for or against carrying passengers or goods; they would be sure to carry passengers and goods as soon as they could, for their own profit; and it might be stipulated, that after any coach had earned a certain sum in bounty, it should not be entitled to more. The effect of such public rewards has been very striking in the case of the invention of means of ascertaining the Longitude at sea. Another way would be, instead of money, to give exclusive privileges for a term to any persons who should first succeed in establishing Steam Coaches on specified roads, under specified conditions of performance; or a Society offering a premium, as was done in the case of Steam Navigation to India, would have a good effect; as was also shown in the case of the locomotive Steam Carriages on the railway between Liverpool and Manchester. There a most inadequate premium (only 500*l.*) brought the invention forward more than ten following years of desultory and unencouraged attempts would have done.

You think those means would produce a great effect?—I have no doubt of it; an important result may often be within a moderate sum of attainment, and yet a prudent man will not set about it. It will be certain to cost 1,000*l.* and a year's hard labour of an engineer, whose time is worth 500*l.* more, to make a new Steam Carriage in a proper manner, and bring it to bear as a business, supposing that its performance turns out as near to previous calculation, according to the experimental Coaches now in existence as can be expected, and that no radical alterations require to be afterwards made in it. After succeeding in the attempt, he must expect to make copies of it on the same terms as other makers, who would examine one of the first Coaches he sends out, and copy it with very little trouble. The operations of competent mechanics in making first machines of new invention, and bringing them to perfection in all their details, are necessarily more expensive than those of first inventors, who execute their experimental machines in a slovenly manner with cheap workmanship only as experiments; but when those experiments have been gone through, an extreme soundness and accuracy of workmanship is the only chance of attaining success in the machines which are sent out for real business. For want of experience to direct the mechanic as to the right form, dimensions and weight of each piece of his machine, it often happens that after having made a piece of expensive work, it will prove too slight or too heavy when set to work, and he may have to make it over again as expensively. The copyists, who will afterwards come into competition with him when his machine is brought to bear, will have no such difficulties.

You conceive that a grant of public money as a premium would call forth the necessary degree of skill?—I have no doubt of it; we have had very few instances of invention being stimulated by the offer of public reward; but the instances of ascertaining the Longitude is a most brilliant example. The facility and accuracy with which the Longitude is now determined at sea, is the result of one of the greatest

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efforts of human genius and perseverance. The stimulus of reward has occasioned both modes of it to be perfected; viz. by astronomical observations and by time-keepers; we should very soon have Steam Carriages brought into full use if such a reward were offered.

Have you ever ascertained the duty or performance of work done in respect to the fuel consumed by locomotive Engines?—They vary so greatly, that it is difficult to make a statement. The common locomotive Engines which have been used for several years to draw coal-waggons on railways, have remained without material improvement for a long time, and their performance is very low, being only equal to raising about four millions pounds weight one foot high by the consumption of a bushel of coals, their boilers evaporating about four cubic feet and a half of water into steam with each bushel of coals. Such Engines exert six to eight horse power. Mr. Stephenson's new quick-going Engines on the Liverpool and Manchester Railway are more improved in duty, and are in a progressive course of improvement; but as they burn coke instead of coal, the established mode of computation is inapplicable. Mr. Stephenson's small Engine, called The Rocket, which gained the prize of 500*l.* offered by The Liverpool and Manchester Railway Company, and which was the model for succeeding Engines, exerted about six horse power during that trial, and burned 177 lbs. of coke per hour, which is at the rate of about five millions and a half pounds weight, raised one foot high by the consumption of 84 lbs. of coal; but they have greatly reduced the consumption of fuel in the succeeding Engines on that Railway, owing to inclosing the cylinders of the Engines within the lower part of the chimney, where they are kept very hot, and an increased effect has been given to the fire by blowing the waste steam upwards through the chimney, as I stated before. In the Rocket they were just beginning to be aware of the value of that expedient for animating the fire, and it was done in a degree, but it has been since done more completely.

Do you know how near any part of the Railroad between Manchester and Liverpool runs to the common road?—I cannot say; in passing along the Railway, I do not recollect seeing the turnpike road, except crossing it several times.

The noise made by the Engines used on the Railway is much greater than by the Steam Coaches, is it not?—Yes. Mr. Hancock's Coach makes less noise than any of Mr. Stephenson's Engines; but the power exerted by the latter is much greater than by Mr. Hancock's Engines. The quick-travelling Carriages on the Manchester and Liverpool Railway, when drawn by the last improved Engines, are extremely easy in their motion.

Is it your opinion, that a road would suffer less injury from the fore and hind wheels of a Steam Carriage following each other, in the same tracks on the road, than if they run on different tracks?—That depends upon what kind of action the wheels exert on the road; if they cut it up and disturb the materials, by pressing down some stones, so deep as to displace other stones sideways, and cause them to rise up at the sides of the track, then it is best not to allow such wheels to cut the road twice in the same places; but if the fore wheels roll the road smooth on the surface, and consolidate, without disturbing the materials; that is, if they only press down the stones over which they pass, as much as will produce a close contact, but not so much as to displace the neighbouring stones laterally, then I think the hinder wheels should follow in the tracks of the fore wheels; certainly that is best for the Carriage; and I believe it will be found that it makes but little difference to a good hard road whether the four wheels of a Carriage follow in the same track or not, provided that the wheels are not loaded so as to indent deep into the solid materials of the road. All Carriages ought to have their wheels of such a breadth that they will not leave any material indentations in the road; they should rather consolidate the materials than break them up. If the fore wheels are only so much loaded, in proportion to their breadth and to the hardness of the road materials, that they will consolidate the materials over which they have passed, then I think it is quite as well for the road and much easier for the Carriage, that the hind wheels should follow in the tracks of the fore wheels: the loading of the Carriage may be so arranged that the principal weight will be borne on the hind wheels, and the fore wheels may (by a suitable apportionment of breadth) be qualified to consolidate the road in their tracks, and thus prepare the way for the passage of the hind wheels, with the least wear of the road and the greatest ease to the Carriage. It is quite as much the interest of the proprietors of Carriages, as of the Road Trusts, that the roads should not be cut up by too narrow wheels, for it is always at the expense of horse-labour that the road is thus injured, independently

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of the evil of having a worse road to travel over the next time. If the wheels are too narrow for the load upon them, and the road materials soft, so that the wheels do print tracks in the road, that evil will be greater, if the hind wheels follow the fore wheels than if they run in new paths; but it is better to remove the evil, by using broader wheels or less load, or harder road materials, and to run the wheels in the same tracks; because the resistance to a Carriage is, in all cases, increased by running the wheels in different tracks, and that with little or no benefit to the road; particularly when the road is covered with mud and wet dirt or snow. The above observations apply to all four-wheeled Carriages, whether they are drawn by horses or impelled by steam; but in common Carriages, the horses' feet tend to dig up the road; I think the Steam Carriages will, when perfected, be free from that objection, and that they have a greater claim to be allowed to run their wheels in the same tracks than other Carriages.

Were you ever in Mr. Hancock's Carriage, when travelling?—Yes; I have ridden on it; but he has put in larger cylinders since I went with him the last time, and I understand makes better progress now. I have examined all his present machinery in detail, and think it very judiciously planned.

Did you find that it frightened horses, or annoyed passengers?—I have stated before, that I found horses were not frightened; but every one must judge for himself, of the degree of annoyance he experiences. Persons who are accustomed to travel in luxurious private Carriages, would find many annoyances in a common Stage Coach, which others would consider as excellent travelling. I am so accustomed to machinery, and to Stage Coach travelling and to Steam Boats, that I am not liable to be annoyed thereby; and I found riding in Mr. Hancock's Carriage to be exceedingly like travelling in a Stage Coach. I heard no complaints by passengers. I believe he has never found any difficulty in getting passengers, since he has run for hire. Persons are reported to be annoyed by the smell of hot grease, in the Steam Coaches on the Cheltenham Road; I can only say, that I never observed such a smell in Mr. Hancock's Carriage. If there are any real annoyances to the passengers in particular Steam Coaches, they will work their own cure in a short time, either by the proprietors finding out remedies, or else giving up their Coaches, as they must do if they are not rendered agreeable to the passengers. The only question that deserves attention is, whether there is any danger to passengers, or any serious annoyance to other persons not passengers.

Did you observe any horses or Carriages passing his Carriage?—Yes, I have always passed through crowds of horses and Carriages with all the Steam Coaches I have tried; there is so much curiosity excited by the novelty of a Steam Coach in motion, that all the horses on the road are drawn up to get a sight of it, and many are turned to follow after it; I have observed that some horses take very little notice of the Steam Coach; others are a little startled, but I never saw any difficulty which the reins could not control with the greatest ease; horses are easily alarmed at any thing unusual, but they very soon become accustomed to any thing, as is shown by the readiness with which horses can be brought to endure discharges of fire-arms and of artillery. A patent was taken out some years ago for what was called a Travelling Advertizer; it was a small four-wheeled Carriage, supporting an enormous octagonal tower, which was stuck all over the outside with printed bills for advertizements; it was drawn very slowly through the streets by one horse, and had a most unusual appearance: this machine was indicted as a nuisance because it frightened horses.

Have you never observed horses to shy at a Stage Coach when heavily laden?—I have observed horses to be alarmed at the enormous bulk which some of the vans carry at times at a great height above ground; horses are the most timid animals to encounter every thing that they are not accustomed to, and the most courageous animals to encounter every thing that they are accustomed to, even when really terrific, such as discharges of fire-arms.

Had you occasion to turn any sharp corners when in Mr. Hancock's Carriage?—Yes, many; the yard of his premises is exceedingly narrow and inconvenient to turn into and out from, but it is done with ease by the Steam Coach; but the same place would not do at all for a coach and four horses to put up at.

Going at what speed can you turn round a sharp corner without any danger?—I do not remember turning with any considerable speed, nor should it ever be attempted with any Carriage if it can be avoided, and there can be no pretence or necessity for going quick when turning a Steam Coach, as its power is quite controllable, in which respect it has a great advantage over a common Carriage; for

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four horses at the moment of turning, are very little under the control of the reins, particularly the leaders, and it depends upon their good will whether they choose to go slow or go quick when turning. In a Steam Carriage the conductor has such a perfect control of the power, that he can never fail in checking the speed at the moment of turning. I observed that Mr. Hancock's Carriage is steered with the greatest ease and will turn round in a very short space: I have seen him turn round in the New Road to return without backing the Carriage at all, although he was in the middle of the road when he began to turn.

If you had turned a sharp corner, could you have stopped immediately on meeting a Carriage?—Yes; the power of stoppage is most remarkable; that is one of the great advantages of a Steam Coach. I have steered Mr. Hancock's Carriage myself, and found it to be most completely under control.

The Carriage may be turned in the smallest space that the wheels will permit it to go round in?—Yes, in a much smaller space than a Carriage with horses can turn, because it is so much shorter in the total length, and the power being completely under control, there is no danger in turning quite short; whereas no prudent driver will turn a four-horse coach round in a road, without the guard getting down and holding the leaders' heads; for they are not sufficiently under the control of the reins in turning to do it with safety.

Did you ever see a Steam Carriage going down a hill?—Yes, down the hill of the New Road at Islington; and it was done with more safety than with any Carriage with four horses; but I do not contemplate the descent of Steam Coaches down very steep hills, for that supposes their getting up such hills, which is not likely to be accomplished soon, and the present Coaches seem to me to be only fit for our most improved lines of roads, where all very steep hills have been reduced to moderate slopes.

Have you turned your attention particularly to the subject of going up steep hills, and what ascent do you think can be surmounted?—In forming my opinion of the probability that Steam Carriages will be brought to bear, I could not overlook the circumstance that they would have to go up and down hills; but most of our great lines of roads are now so improved, that what were formerly called steep hills are not very numerous or frequent; but wherever they do occur, I propose to give the Steam Coach the assistance of a pair of post-horses in aid of its own power. In going down hill, Steam Coaches are very safe, because the whole power can be effectually exerted to retard or resist the turning of the wheels.

Mr. Gurney's Steam Coach has gone up Highgate Hill without horses?—Yes, but I understood that it was broken to pieces in coming down again. My objection to attempting to make a Steam Coach go up a steep hill, in the present state of our knowledge, is, that it requires to have a great strength, and consequent weight of machinery to have a sufficient power to do so with safety, and which weight is a useless incumbrance and impediment to progression at all other times. The question is, whether all the machinery of a Steam Carriage should be made twice as strong and heavy as is necessary for impelling it with safety on a tolerable level road, merely that it may have power within itself for going up a few occasional hills, or whether it is better to make the machinery lighter, and take the occasional assistance of a pair of post-horses. There can be no objection to the latter expedient, except the expense of such horses; and as the Steam Coach can carry goods to profit in place of all the weight of machinery which is saved by making it lighter, I think that the aid of post-horses would be an economy. In forming such an opinion, I follow a maxim which I have always found to hold true; viz. that Steam power is certain to be more profitable than horses, if the work is to be kept constantly going on, because then the great advantage of Steam power, that it does not tire, becomes fully available; and to perform the same service by horses a very great number must be kept for change; but for businesses which require only occasional working, or for working during only as many hours each day as horses can do without changing, Steam power loses its great advantage over horses, and in some cases they will do the work cheaper. One great item of the expense of Steam power is the first cost of machinery and engineers' wages, both which would be only the same for working twelve hours per day as for one hour and a half, which is the utmost that a Stage Coach horse can draw at ten miles an hour. A Steam Coach should work twelve or fourteen hours in every twenty-four hours, to gain the full advantage of the system of Steam power over horse labour; the intervening ten or twelve hours will allow ample time for putting every thing in perfect order for the next journey, if the machinery is what it ought to be; and there should be a spare Coach for every two which

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which are running, to allow time for more considerable repairs : hence I reckon that three Steam Coaches should keep up a double passage of 100 or 120 miles a day continually. Expensive machinery, which is only to be worked occasionally, will not in some cases do work so cheap as it can be done by men or by horses without machinery ; and that I conceive to be the case with the extra cost, weight, strength and complication which must be given to the machinery of a Steam Coach, in order to enable it to go safely up steep hills without assistance. I apply these remarks to the present Steam Coaches, but future improvements may in time produce that species of machinery which will effect the going up hill with less difficulty than the present. It has been supposed that the diameters of the cylinders being larger than is necessary for going on level ground, they could be worked with a diminished strength of Steam to go on level ground, and stronger Steam when going up hill. To get up ordinary and moderate hills, that is certainly the right plan ; but it requires the strength of all the moving parts of the Engines to be made sufficient to bear the utmost force that the pistons can exert when impelled by the strongest Steam that is ever to be used ; also, the large wheels which run upon the road should be made very broad on the edges, and of proportionate strength. The present Coaches have been faulty in these respects, and yet the machinery is too heavy. Another way of getting sufficient power to go up hill, is to have the pistons only a suitable size for going along the ordinary road, and to introduce wheel-work, which can be thrown into action when a hill is to be ascended, and which will turn the wheels of the Carriage round only once for three turns of the cranks of the Engine, and consequently with a triple force. Mr. Hancock has shown me the parts of such machinery which he is now making for a new Steam Coach, with wheel-work and endless chains, on a plan which I think very likely to answer for ascending moderate hills ; but for very steep hills I think it is desirable to have a help by post-horses. The immediate desideratum is, to construct a Steam Coach with the power and strength necessary to go quickly and safely along the best lines of road which can be found, without any steep hills upon them, and taking assistance of post-horses where it is necessary. If that is accomplished, and such a Coach is worked continually for two or three years, it would probably lead to the knowledge of the proper kind of machinery to go up steeper hills ; but if the adoption of Steam Coaches is to wait until they are rendered much more perfect, it will be a very long time, because practice is essential to finding out a proper plan.

Do you think there is any danger in going down a hill in a Steam Carriage?—Much less than in a common Stage Coach ; for by backing the Engines, so that their power is brought to act in opposition to the turning round of the wheels, and with the assistance of drags or brakes, rub on the rims of the wheels, and aid in retarding their motion by friction, Steam Coaches will safely get down all moderate hills, such as are met with on our best lines of turnpike roads, say between London and Holyhead ; and with machinery such as Mr. Hancock is now making, if it is suitably proportioned, I expect a Steam Coach would not require assistance to get up hill at more than five or six places between London and Holyhead.

Stanmore and Highgate Hill you call moderate hills?—Not the old Highgate Hill ; but the Archway is a very fair road, on which a Steam Coach should not feel the least difficulty. I do not call those moderate hills which are common on the roads in many parts of Devonshire and Cornwall ; it will be a long time before Steam Coaches will be able to travel there ; and the goodness of the roads is to be considered as well as the slope. No Steam Coach that I have seen, possesses that strength and weight of machinery which, being on the present construction, will enable it to get up even a moderate hill without risk of breaking ; for though it may climb up the hill by accumulating the strength of the Steam, the parts have not been made strong enough to resist the strain to which they are then subjected, if they were frequently used ; and if the work were made, on the present plan, strong enough to endure the extra strain of getting up a steep hill with safety, there would be too much weight of machinery for travelling on the ordinary road.

Can they ascend a hill so steep as one in eighteen?—That I think is too much for them, without the aid of horses, unless the surface of the road were of the very best quality ; but such hills are usually bad roads.

Are they competent to ascend such a hill as St. James's-street?—I have not a very particular recollection of the slope of that hill, but I believe it is paved, and I think that it would be about their maximum ; for a great deal would depend upon the surface of the road ; they would go up all the length of Regent-street, which is, I expect, almost as steep as St. James's, but it is a better surface ; and I think they

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should go up any good road not exceeding a rise of one in thirty; and if more inclined, or if the road is bad, they should be allowed one or two horses. I doubt if they could ascend the Pentonville hill in its present shameful state of neglect; but if it is made good, then I think they might.

Have you turned your attention to the subject of apportioning the Tolls on Steam Carriages, so that they may bear their due proportion to the Tolls on Carriages drawn by horses?—No, I have not paid much attention thereto; it is a subject which would require more consideration and more data than I have before me. I am convinced that if a Steam Coach, complete when travelling, weighs no more on an average than a Stage Coach with its four horses complete weighs on an average, there is no reason for charging any extra toll for Steam Coaches, but on the contrary, I believe it will turn out in the sequel that they ought to go for less toll, because they will wear the roads less than the present Coaches whenever they are made really efficient; and in the mean time, until that is accomplished, I think it may be very safely left to the chance of events as to injuring the roads to any extent whatever, by injudicious attempts to work Steam Coaches of an injurious construction, on the consideration that if any new Coach which may be started, does injure the road, it will be very soon given up from its own demerits, probably before it has produced any visible effect on the road. Suppose its wheels were to slip so much as to plough out ruts on the road, it would most likely stick fast, or be broken to pieces in the first journey along the road, and such abortive attempts will not be repeated very frequently. It is idle to talk of one or two Steam Carriages doing much visible injury to a frequented road in a year or two, even if they run constantly, for suppose that it wears the road four or five times as much as one Carriage of the same weight drawn by horses (including those horses in the weight,) it would only be equivalent to four or five additional Coaches passing each day, and that on the road from London to Birmingham, for instance, would be quite imperceptible. I am confident that any Steam Coach which does a road any greater damage than equivalent to Carriages drawn by horses, will fail of itself in a short time, and prove an unsuccessful project. I should strongly recommend the new system to be left to its own chance of success or failure, as far as the roads and the safety of passengers are concerned; and I think the same reasoning applies against any regulation for the breadth of the wheels for Steam Carriages, because they will not perform well if their wheels are so narrow as to cut the road materially. I understand that the old system of regulations and penalties, as to over weights on given breadths of wheels for common Carriages, has been done away with on the roads in an extensive district round London, and I think that is good policy, from the circumstance that the proportion regulates itself by the interest of the owners of Carriages, when the fact is understood that Carriage wheels, which are too narrow in proportion to the load on them, and to the hardness and goodness of the road, will always draw heavier than wheels of a suitable breadth; and that though the carriers may not find out the proper breadth at once, they will do so in the end. The old Acts for forcing the use of very broad wheels by making tolls operate as penalties and premium, was a most injudicious system of legislation, and did nothing but harm; the carriers soon found out how to evade the intention of the Act, by using very broad conical or barrelled wheels, rounding on the edges, which conformed to the words of the law, but which acted on the road like narrow wheels. The broad wheels intended to have been encouraged by the old Act of Parliament, were expected to act as rollers to make and improve the roads, and were encouraged to carry excessive loads for that object; but if the wheels of the broad wheeled waggons actually used had been really such as the Legislature contemplated, they could not have been continued in use on account of the great increase of draft; but the broad wheels actually used, carried such loads, that they crushed the road materials to powder, owing to the conical form of the wheels and the bending of the axletrees; they bore on the road almost wholly at the inner edges of the iron tires, and not across all their breadth, as was intended. The advantage to the carriers in tolls and in increased loads, induced them to use such broad wheels, when it would have been against their interests to have done so, if they had paid the same tolls for the weight of goods as other carriers, and their operation on the road was more injurious than any other Carriages. There is no particular breadth of wheels which can be prescribed as the best to carry given loads over all sorts of roads, for much depends upon the hardness of the road materials, the size to which the pieces are broken, their general form and disposition to consolidate into a hard bed, the resistance the materials offer to wet and frost, and to wearing by the wheels, the breadth of the wheels,

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and the load upon them, should be adapted to all the combinations of circumstances, and the carrier will soon find, if his wheels are not best adapted to the road, by the draft being greater than it ought to be. As to Steam Coaches, the wear which will take place on roads, from all that can, by any probability, be expected to be brought into use for some years, will be so small that it cannot be felt for a considerable period, and when it is felt it will be time to look round and see what is the real effect on the roads of those particular Coaches which are in use, and apportion the tolls that they ought to pay.

Is it your opinion that weight for weight, including the weight of horses on one hand, and of Engines and an average of the water and fuel on the other, the tolls should be the same on Steam Carriages as on horse-drawn Carriages?—I think that if it were so it would prove a considerable advantage to the roads, because, as I have stated before, I think the roads will be considerably benefited by the change of impelling by steam instead of by horses. I think it will be a great public benefit when Steam Coaches come into common use, and hence that it is expedient that a moderate bounty should be offered for the adoption of Steam Carriages, by giving them all possible advantage they can have without trenching on the interests of individuals; and if they were allowed to run toll free, and duty free, until a certain number were in use, or during a certain time, it would much accelerate their introduction, because it would diminish the loss that must necessarily be incurred by running them before they are perfected in their construction; small encouragements or discouragements have a considerable effect on new inventions in their infant and imperfect state. The advantage to the public from Steam Navigation is now generally acknowledged; but when Steam Boats were in their infancy an attempt was made by the watermen on the Thames to suppress them, by contending that, according to their charter, and the usage of the City of London, no persons could be allowed to own a vessel plying for passengers on the Thames, nor to work on board of such a vessel except they were freemen of the city, and belonging to the watermen's chest. This would have effectually prevented any engine men being employed, and in addition the watermen engaged all their members to refuse to navigate them. After a long dispute and delay of the Steam Boats, it was decided that one out of a number of owners being free was sufficient, and that the men employed to manage the Engines were not subject to the watermen's regulations of freedom of the river; some watermen were induced, by giving them small shares in lieu of wages, to exercise their right of freedom in favour of the real owners, and to navigate the vessel. It was afterwards attempted to get the measurement and calculation for the registered tonnage of the Steam Vessels made according to the extreme breadth across the projecting boxes which contain paddle wheels, under the pretext that they occupied that width in the river and in harbours, instead of measuring the breadth of the vessel at the surface of the water. If that could have been enforced it would have nearly doubled all the rates on Steam Vessels compared with other vessels; but the subject being brought before Parliament, an Act was passed to give them the advantage of deducting as much from the length of the vessel as is occupied by Engines and Machinery in calculating the registered tonnage. This was in effect a small bounty upon Steam Vessels, for they have no claim to such an advantage over sailing vessels, when the weight of masts, sails and rigging, in the latter is not deducted in calculating their tonnage. The effect of that measure has been favourable to the advancement of Steam Navigation, for though it was but a very trifling bounty, and is now of no consequence, it came as a well-timed aid, at the date when that Act passed, because almost all Steam Vessels were then navigated at a loss, they were so imperfect (like Steam Coaches at the present day,) that their Engines were continually getting out of order, whereby they failed to make their passages, and required expensive reparations, their consumption of fuel was great, and the wear of boiler excessive; on the other hand, few passengers would go by them at first, and some terrible accidents which happened in a few vessels caused them all to be avoided by passengers for a long time; it was only by persisting in keeping them going as well as they could, and thereby gaining experience in their management, that the numerous defects of their construction were remedied; most of the earliest Steam Boats had two or three successive editions of engines and machinery before they were rendered so perfect as to become profitable; and in addition to the expenses of such alterations and improvements in the machinery, they were obliged to make their passages regularly for some time after they were rendered tolerably effective before they acquired sufficient confidence with the public as to their safety

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and punctuality, to enable them to obtain as many passengers as would pay the expenses of navigating the vessels. For all these reasons, any increase of their expenses was severely felt, at that losing period; many were abandoned, and the difference in the expenses occasioned by the rates to which vessels are liable, being calculated according to the breadth across the paddle-wheels, or according to the Act passed for measuring them short by all the space taken up by the Engines, would have occasioned others which have been brought to bear to have been given up, before they had attained so much perfection as to enable them to earn their expenses. In the same manner the tolls levied upon Steam Coaches at present are to be regarded, not as payments out of the profits of a gainful trade, but as an increase of loss upon that which is yet, and which must inevitably continue to be for some time, a losing business. The ultimate success to which I look forward is entirely dependent on the circumstance of the first speculators in Steam Coaches being enabled to go through a sufficient term of inefficient performance, and consequent loss, to acquire experience in the new business; and that experience will, no doubt, lead to expensive alterations and reconstructions of their machinery. There is so much mechanical talent to be had for money, that I have no doubt of the final accomplishment, if the attempts now making are continued long enough; because I am confident that there is (as was the case in Steam Boats) a real efficacy in the principle of action. The general opinion of Engineers was not very favourable to Steam Boats when they were first brought forward as a novelty; many doubted if they could ever be made to perform well, particularly at sea; and others, who foresaw the possibility of that, doubted whether they would answer in point of expense of fuel, and wear and tear of engines and boilers. If no assistance or encouragement is given to new inventions when they are in the infant state which Steam Coaches are now in, persons who find that they only lose money when they expected to gain, by being the first to adopt the improvements, are liable to become disheartened, and give up the pursuit too precipitately, whereby their undertaking dies a natural death; and that is sometimes the case when it might have been established by another two or three weeks' continuance of the efforts; and that continuance might be induced by some small relief, like the reduction which was made by Parliament in the register tonnage of Steam Vessels, or the taking off of tolls from the earliest Steam Coaches. If by any means they are enabled to go on till the proper plan of machinery and management is found out, they will afterwards keep their ground, because the profit of working by steam in lieu of horses will be very great. The present Steam Coaches are mere experiments, and the next editions of each plan of them will, I expect, be losing concerns, and will continue so to be for some time under those circumstances, every small increase of their expenses is a real retardation to that practical establishment of the invention which will render it useful to the public; such retardation by small causes is operative to a greater extent than can easily be conceived. Steam Coaches will very well bear all tolls and taxes to which other Coaches are subject, when they are able to carry passengers regularly and profitably; but they want encouragement now, instead of difficulties being thrown in their way. As to the right of tolls on turnpike roads, it should be recollected that turnpike roads are not property, like canals, but trusts, to be exercised for the benefit of the public; and if it is for the interest of the public that Steam Coaches should be brought into use, and if that bringing into use will be accelerated by suspending the tolls on them at first, the trustees of roads ought not to object to such an arrangement; the real amount of tolls they will forego, will be an exceedingly small per centage on the income of their tolls; for so long as Steam Coaches are losing concerns, they cannot be very numerous.

In the course of your examination, have you meant to confine your Evidence to Steam Coaches?—Yes, to Steam Coaches for public conveyance of passengers and parcels in the manner of Stage Coaches, and travelling at the rate of ten miles an hour on our best lines of turnpike roads, with occasional assistance of one or two post-horses, where necessary to surmount unusual hills or very bad pieces of new laid road. If it were thought admissible to begin with travelling at a less speed than that, and to carry goods only in the manner of Vans, the thing is nearer to accomplishment, because the accommodation and comfort of passengers would then be out of the question; and also the violence to which quick travelling Carriages are subjected, requires a greater strength of all the parts than would be necessary to carry the same weight at a slower speed. In other respects, Steam power will propel a Carriage as cheaply at a quick rate as at a slower rate; that fact is proved on railways, in actual business; and Steam Coaches will be the same whenever they can be made

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made strong enough to bear quick motion without being overloaded with weight of machinery. That will be one of their great advantages over horse labour, which becomes more and more expensive as the speed is increased. There is every reason to expect, that in the end the rate of travelling by Steam will be much quicker than the utmost speed of travelling by horses; in short, that safety to travellers will become the limit to speed, as is now the case on railways.

What is your opinion as to impelling waggons by steam?—I have never considered that at all in detail, and am not prepared to give evidence upon the subject. The price of carrying passengers or goods at a quick speed, as is done by Stage Coaches or Vans, will always be so much higher than the prices of carrying an equal weight at a slow speed, as is done by waggons, that I see no inducement to attempt Steam Waggons, which I think would present almost all the same difficulties as Steam Vans. According to theory, the cost of carriage by Steam will (as I have stated be proportionate to weight and distance, without regard to speed of motion; for instance, to convey a Coach loaded with two tons for a distance of ten miles only, the same fuel will be consumed and the same wear of machinery will be occasioned whether that distance is run in one hour or in four hours. The wages of engineers, conductor and guard will be only one-fourth with the quick speed, and the first outlay in machinery would be only one-fourth, because four times as many engines must be on the road, with their attendants, at the same time, to do the work at a slow speed, as at a quick speed; but the money earned by the carrier at the slow speed, will be only a small part of what would be earned at the quick speed.

Taking into consideration the comparative expense of horse Carriages and Steam Carriages, do you suppose that Steam Carriages will be able to run for half the charges of horse Carriages?—My own idea is, that Steam Coaches will very soon after their first establishment be run for one-third of the cost of the present Stage Coaches; but to become a business at all it must necessarily be a business which will offer strong inducements to persons to embark in it; and to do that the rate of profit must be very much greater than that which is commonly expected to be realized by the proprietors of Stage Coaches; their present trade affords a less profit on the capital and trouble of management probably than any other sort of business which is carried on with spirit in this country. The great reason of that is, the constant loss by destruction of horses, the fluctuations of the price and quality of horse-keep, and the impossibility of reducing Stage Coach establishments in times when travelling business is flat; because the horses must be kept and men to attend them at all events, and the loss of running a Coach half employed is not so great as suspending it, and keeping the horses idle on short allowance, till better times come round. The profit of Stage Coaches which load well is very high, particularly in the fine travelling season, and that occasional profit creates an excitement which induces the injudicious setting up of more Coaches than are wanted for an average of all seasons; and for the reasons above stated, their expenses when once set going, cannot be reduced to meet bad times. The adoption of Steam Coaches will set the trade free from its great commercial difficulty, because they can be laid up and kept idle without considerable loss and brought out again when wanted without any new outlay; also fuel does not fluctuate either in price or quality to any considerable extent like horse corn. In short, the capital embarked in a Steam Coach trade will not be so rapidly wasted as at present in horses. Owing to the great number of horses which must be first bought and then kept to do the same work as one Steam Coach, the first outlay in stock will be very small in Steam Coaches, compared with horses, the same of stables, hostlers and harness. The daily expenses of fuel and attendants will be very much less than that of horse keep and attendance; the wear and tear of the Coaches and all that is coachmaker's work will be only the same as at present, but the wear and tear of Engines and machinery, though a very expensive item on each Engine, will be nothing to compare with the present repairs, loss and decay of horses, because the number of Engines is so small. Stage Coach horses require to be all renewed every three years, notwithstanding a heavy annual expense for what may be called repairs of horses; viz. harness, shoeing and farriery. Engines with an equally heavy annual expense of repairs to that of horses, will, when perfected, be kept up thereby in such a state as to last for many years without renewal. The metal parts of machinery only wear at particular places, which are capable of being repaired or renewed, so that they become as good as new; but a horse when worn to disease at any part, feet, eyes or lungs, becomes incapable of Stage Coach work for ever afterwards.

Do you apply the principle you have stated respecting the probable wear of the roads by Steam power being less than by horses, to heavy waggons?—Yes; my

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proposition that the wear of the roads will always be at the expense of the carrier, applies to all Carriages whatever, but more particularly to those impelled by Steam than to those drawn by horses, because Carriages drawn by horses may be so mis-managed, as to do very great injury to the roads, and yet may make good progress in travelling; for instance, a waggon having very narrow wheels, carrying a heavy over-load, having a sufficient team of strong heavy horses, may be drawn along although it breaks the road up to any extent, and that as much by the feet of the horses as by the narrow wheels; but if it were attempted to impel the same waggon by Steam power acting by the adhesion of the wheels to the road, they would slip round, and it would not get along the road. I am confident that Carriages to be impelled by Steam machinery turning the wheels, cannot be made to answer any good purpose, either for conveyance of travellers or goods, so long as they materially injure the roads, because if the wheels slip materially on the road, or if they cut sensible ruts in the road, they will not advance the Carriage efficiently. On the other hand, horses may be made to draw a Carriage which will injure the road. I think that principle must apply to Steam Waggons as well as to Steam Coaches.

Then the heavier the loads to be drawn, the more important it is to apply Steam instead of horses, if the roads will be benefited by that substitution?—I think so, as far as the roads are concerned, but I doubt if Steam Waggons will offer any comparison of the profit to be derived from Steam Coaches. To get along the road, Steam Waggons will require very broad wheels, and there is no danger of doing injury to the road by them, for they will not get along if the wheels are too narrow, but narrow-wheeled waggons drawn by horses may do an injury to any extent, for extra horses may be put on, and they will injure the road with their feet at the same time that they draw a Carriage after them, which also injures the road. It will be a loss to the carrier to do so, but there is nothing in the nature of the operation to prevent it being done, as there would be in the case of Steam Waggons.

Of course, a Steam Carriage going slower than ten miles an hour will be more expensive to travel, on account of the greater expenditure of fuel?—No; the consumption of fuel, according to time, would be as much less as the motion would be slower; so that the consumption of fuel, according to distance, would be the same, whether for a quick speed or for a slow speed; but when profit is considered, every thing is in favour of quick speed; because all goods carried slow must be carried cheap; and quick conveyance will bear the highest price of carriage, on account of the expense of going quick by horses. For instance, a ton of goods may be carried a mile by Steam power with a certain consumption of fuel, but it should take no more fuel to carry it a mile, at the rate of two and a half miles an hour than at ten miles an hour; there is some qualification to be made in that statement according to the state of the roads; it will be true if they are hard and good, but if they are heavy, the expense of fuel will be a little more for the quick speed than for the slower speed; and it is also to be understood, that the Engines must be suitably proportioned for attaining quick speed, because Engines, which are only adapted for slow motion do not work to so great an advantage when they are urged to work quick as when they are worked at or below the speed which the proportions of their parts are adapted to move with; nevertheless, that extra expense of going quick by Steam power will be but small, and nothing like the increased cost of travelling quick with horses; for horses have only a limited speed at which they can travel, if they have no load to carry or drag after them, the whole of their muscular strength being then required to advance the weight of their own bodies; the speed with which Stage Coaches now travel, approaches so near to the speed with which the horses could travel without any load, that their force of draught becomes very small. In all cases, horses lose force of draught in a much greater proportion than they gain speed, and hence the work they do becomes more expensive as they go quicker. The quickest stage-coaches travelling is now at the rate of eleven miles an hour, and that appears to be very near to the utmost limits which nature has prescribed for animal exertion; for those horses require renewal of the whole stock every two or three years. This is a comparison of Steam power and horse labour, during the time that each is actually in operation; but the real difference between the performance of a Steam Engine and that of a set of horses will be found to be very great, when it is considered, that by having one spare Steam Coach for every two or three which are on the road, those Coaches can travel continually all the year round, during fourteen or fifteen hours in every twenty-four hours, without any intermission, except stopping

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stopping for one or two minutes to take in water at every stage of about seven or eight miles; and thus each Steam Coach can travel 140 or 150 miles a day; whereas a set of four stage-coach horses can only work during seven hours and a half out of every twenty-four hours, or each horse can run fifteen miles a day, and that exertion wears them out very soon. A cart-horse, travelling at the rate of two miles and a half an hour, can work during eight hours out of every twenty-four hours, or he can travel twenty miles in a day. Suppose that in both cases, of horses going ten miles an hour or only two miles and a half an hour, the force of traction was the same during the time that they were actually drawing; even on that supposition, there would be the difference between twenty miles a day and fifteen miles a day in favour of slow travelling; but in considering the work performed, the great loss in the force of draught by quick travelling must be taken into account; and it will be found that a cart-horse, walking at two miles and a half an hour, could draw with a force of traction 100lbs. on an average, but that a Stage Coach-horse, running at ten miles an hour, cannot exert more than 28lbs. force of traction at an average. The above proportions of distance travelled, and force of traction exerted in each case being combined into one product, the proportion will stand thus:—20 miles a day $\times$ 100lbs. draught = 2000, to represent the work done by a horse travelling at the rate of two miles and a half an hour, and 15 miles a day $\times$ 28lbs. draught = 420, to represent the work done by a horse travelling at the rate of ten miles an hour, which is $4\frac{1}{2}$ to 1 in favour of a slow speed; when with Steam power there would be only a very slight difference of performance, at the quick or the slow speed.

Respecting the injury done to the roads by heavy Carriages, whether they are drawn by horses, or impelled by Steam power, you consider that weight for weight (including horses and engines as part of the weight) the one will not do more injury to the road than the other?—In my opinion the Steam Carriages will do the least injury of the two. The horses by treading with their feet excavate and scrape out depressions in the surface of the road, that is particularly the case before the road materials are consolidated into a solid mass; and the evil of depressions or holes in the road is not merely the injury done by the feet of the horses to those particular parts of the road in which the depressions are made, but the wheels of other Carriages, which pass over such depressions, drop heavily with force into them, so as to make the depressions continually deeper and larger, and to loosen the surrounding stones. In this manner the horses after injuring the road themselves, prepare the way for further injury to the road by the wheels of Carriages. For to have the full benefit of the rolling action of the wheels, in consolidating the road materials, the latter must be laid smooth and level before the wheels come upon them; but if the materials are previously thrown up into little hills and holes, the wheels will do mischief instead of good.

Suppose the Engine and machinery in a Steam Carriage to weigh two tons, and to be able to advance an additional load, equal to their own weight along a good road, at an average speed of ten miles an hour, do you think that any additional toll should be imposed upon Steam Carriages beyond that paid by four horse Stage Coaches, or Vans; assuming the four horses to weigh two tons, and to draw a load of two tons, at the rate of ten miles an hour?—In such a case I can see no reason whatever for any increase of toll; but the diminished wear of the roads, which I anticipate from the use of Steam in lieu of horses, will be a reason for a reduction of tolls, whenever such a diminution of wear is realized.

Would horses drawing 80 cwt. upon a road, with a slow walking pace, in your opinion do more injury to the road than an Engine doing the same work?—I have had no experience of drawing heavy weights by Steam to enable me to form an opinion respecting the effect that the broad wheels, which must then be used, would have on the road, and what advancing power they would have before they began to slip on the road, without advancing the Carriage forwards; nor what would be the weight of Engines which could advance 80 cwt. at a slow speed. I feel some doubt of the practicability of making Steam Engines advance so many times their own weight, as I expect it would be, with effect, and I feel confident that in the present state of the art, there would be no profit in doing it; but if it were accomplished I believe that the broad wheels of the Steam Waggon would do no injury to the road, whereas in heavy waggons, drawn slowly by horses, the horses do far much more injury by digging and scraping with their feet than is done by the horse in Coaches and Vans travelling quickly; because the waggon horses having a heavy pull

to make, must choose places in the road where they can place their feet in depressions in order to get hold ; hence on a good smooth road they slip and scrape up the surface.

Veneris, 12^o die Augusti, 1831.

DAVIES GILBERT, ESQUIRE,

IN THE CHAIR.

Mr. *Richard Trevithick*, called in ; and Examined.

Mr.
Richard Trevithick.

12 August,
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HAVE you been long conversant with Steam Engines?—Twenty-six years ago I invented a high pressure Steam Engine and a locomotive Engine, and since that time Boulton and Watt's Engines have been thrown aside in Cornwall, and the high pressure Steam Engines, with the improvements upon the boilers I have made, have been throwing Boulton and Watt's Engines constantly out of use, there is not one of those now in use in the mines. The average of the duty of Boulton and Watt's Engines, about twenty years ago, was taken by Mr. Gilbert, which gave, perhaps, about seventeen millions of pounds, lifted a foot high with a bushel of coals ; and sometime after that, Mr. Gilbert made a Report in the Transactions of the Royal Society, that he had found one of my high pressure Engines in Cornwall was doing seventy-five millions ; and in the same Report he stated, that they were doing nearly as seven to twenty-eight or four to one, and as ten to one on the Atmospheric Engines.

Have you lately paid attention to Steam Carriages on common roads?—I have noticed the Steam Carriages very much ; I have been abroad for a good many years, and had nothing to do with them until lately, but I have it in contemplation to do a great deal on common roads ; Railroads are useful for speed, and for the sake of safety, but not otherwise, every purpose would be answered by steam on common roads.

Is your machine applicable to Steam Carriages?—It is chiefly for that purpose, it works without water ; now the Manchester Carriages use four tuns a day, two tuns that they take in when they start, and two that they take in midway of their journey ; there is that weight to carry, and the loss of time.

You conceive Steam Carriages to be applicable to common purposes?—Yes, to every purpose a horse can effect.

Have you any plan particularly applicable to that purpose?—Yes, I have taken out a patent for that purpose ; this, the Plan which I produce, [*producing the same,*] will show the principle. I built a twenty-horse engine in Cornwall, in order to try this : this I produce is for a Ship Engine. [*Mr. Trevithick explained to the Committee the different parts of the Machine on the Plan.*] The bursting of boilers has been occasioned by the boilers being left under gauge, neglected to be charged with water, and, I believe, by their getting foul and incrusting with salt from using salt water ; the low-pressure Engines have burst as well as the high-pressure ; if the tubes of the boilers are heated red-hot, and the Engine is standing at the time the water is still in, the boiler is quiet ; but on the Engine setting to work, a discharge of steam from the boiler to the cylinder causes a great ebullition in the boiler, and the water splashing over the hot sides makes a superabundant generation of steam. The space that would be filled instantaneously from the hot tubes being suddenly cooled, the space occupied by that superabundance would fill three hundred times the space usually allowed for steam, and a safety valve of five times the size would give no relief, or not in time ; a proof that a high-pressure Steam Engine boiler has not been broken generally by the pressure of the high steam, but from being heated, is because the portable gasholders are about ten inches diameter, and the sixteenth of an inch thick, and they are charged with 30 atmospheres, or 450 lbs. each without accident ; an accident never happens to them, and the pressure is not so great as on half of the strength of iron ; the boilers of Steam Engines in Cornwall have burst that have not been loaded to an eighth part of that pressure for the same substance and size of boilers ; therefore that is a proof that they must have been broken

broken by the heating of the boiler, and suddenly cooling it by a sudden expansion. The gasholders have never been heated and have never been injured; I have known instances where by turning cold water into a red-hot boiler they have exploded. An Engine I had the care of was injured by the neglect of one of the enginemen in that way. The boilers to the high-pressure Steam Engines on my construction are cylinders, one in the other, the inner cylinder containing fire, and the outer cylinder surrounds the water and leaves a space of about a foot between the two tubes for water. Where they have been neglected the fire-tube has been made red-hot, and the splashing of the water over the hot tube from the ebullition occasioned by the escape of steam, has burst the boiler by the water flowing over the red-hot sides, and generating steam faster than it can be discharged.

By neglected you mean that the tubes were not completely covered with water?—They are not covered with water. With my inferential Engine, that never can be the case.

Have the goodness to state to the Committee your opinion with respect to the wear of the road by Steam Carriages?—I think that the roads will not be injured so much by Steam Carriages in future as they have been, because there will be no need to chain the wheels; by putting the valve to the stop, the steam going off that has never yet been applied, there is no need to chain the wheel; that is very easily done; if the steam is prevented escaping, the piston must stand still, and it can be let down as gently as possible; they may either stop instantly or go as easily as they please; the throttle barrel will answer the purpose to throttle between the cylinder and the discharge pipe; that would be a saving of the roads.

Have you made any observation on the injury done to the road by a Carriage propelled not in the usual manner but by a motion communicated to its wheels?—I think the roads would be less injured by Steam Carriages than by horses, because the wheels will have very little more to carry now than they have with horses, and there are no horses' feet to injure the road, therefore that part of it is saved; the Engines now will be so very light that it will be scarcely felt; the power to draw the Carriage will be very little more than the weight of harness on the horses.

Would you be inclined, for the advantage of the road, to give greater width to wheels if you give greater velocity?—I would rather give greater width; I do not think the road is injured so much, there is less friction; if a two-inch wheel goes two-inches deep, and a four-inch wheel goes only one inch deep, there is two to one difference in the friction, for the ascent in getting up out of a two inch rut requires a great deal more friction; the wider the wheels in my opinion, though the greater extent the less the friction; they use wide wheels to go over soft ground on farms to prevent their sinking; there is a great friction, for it is always going down hill and the friction is pulling it up hill; there is a power thrown away, but that would not have been the case with a wider wheel.

Do you think for a greater weight with a great velocity of carriage, you could put wheels so wide that instead of doing injury they should do good to the road?—Yes; I think if the wheels had been as wide as they ought to have been to take the advantage of ease, they would rather have done a service to the road than an injury, that is to settle down the road; but the greatest folly I have ever seen is the wide waggon wheels which go free of turnpike duty, one part is nine feet round and the other part not above seven and a half or eight feet, one part is going faster than the other, and the one part must rub; had the wheel been upright and it was turned off, the point only would meet, but it would not be rubbing.

There is a particular width of wheel in which no injury will be done to the road, but rather good?—It will be rather good after the road has been mended to settle it down; there will be wear in it as at other times; but in certain states of the roads to settle them down they will be doing good, but at no state of the road could it do good with narrow wheels.

What would be the effect when the road was once settled?—You see very often roads which have been gravelled; in dry weather the dust blows away; they can never settle again, but if the broad wheels passed over to crush it over with the dust, it would settle down much firmer; but the narrow wheels slide so easy through that they sink down, and shove them on each side.

Is there any state of the road in which you think a wide wheel would do injury to the road?—No; there is no state of the road in which wide wheels will do an injury; if there was to be a wheel of an inch in diameter instead of six inches, it would be like a stamping wheel cutting the road constantly, but the width of the wheel takes off that; the tenacity of stone is equal to the weight.

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Does not the whole of this refer to wheels that are cylindrical and the axles horizontal?—Yes, they ought to be straight; that is the very wheel which I want for a Steam Carriage with straight axles.

Is not the road injured in two ways by the wear of it, and by the separation of the materials?—The separation of the materials is not so likely to take place with wide wheels as with narrow.

That is the reason why narrow wheels injure the roads more than wide wheels?—Yes; and there is a much greater weight upon one pebble than is thrown on two or three, double the weight is thrown on one pebble than would otherwise be; then that pebble is crushed, for the stone does not bear strongly enough together to resist it.

For this reason, the operation of horses' shoes must be much more injurious than that of broad wheels?—Yes; they are more likely to break the hard stones than a dead weight. I think the horses' feet much more likely.

There are certain states of the roads in which the widths of the wheel would occasion your losing power, are there not?—No, I think not. I have heard that mentioned, but I think it is not so.

Is there any slipping or sliding in the wheel of the Steam Carriage?—When the trial for the premium given on the Manchester Railway was decided, the Engines ran for a certain time, and the strokes were counted, and the distance was measured, and there were remarks made upon that day's performance, they found, by measuring the periphery of the wheel, the number of the strokes made, and the distance run, that there was not the least variation whatever; they could find no difference.

Was not that on a Railroad?—Yes.

The cylindrical wheel, with the horizontal axle, is the best for the road?—Yes.

Is there not much less likelihood to slip on a common road, than on an iron Railroad?—Yes.

Suppose there are sharp ascents upon a common road, how would that apply?—There is no ascent that any common carriages go over, where the Steam Carriage will not go down the hill with one wheel chained; no road in the neighbourhood of London that they would not run down with one wheel chained; that is, only one quarter part of the weight of the Carriage, if the wheel is chained, if you are drawing up hill with two or four wheels driven by an Engine, by their all turning round, they are as likely to go up hill. One wheel ought to put it up hill. It will go up a hill of double that ascent without slipping.

Will the increasing breadth of the wheel render slipping in ascending a hill more or less likely to take place?—I rather think that will increase the friction, because that does not tend to make a rut. In making a rut there is a very great difficulty in the wheel getting out of that rut, for there is no footing; but where it does not sink, that is not the case.

Supposing the width of the wheel to be the same on a Carriage and Steam Engine, and the weight of the Carriage the same, do you consider that a wheel perfectly cylindrical, with a horizontal axle, preferable to a wheel dished like that of a common stage coach, with a common axle?—You cannot have a dished wheel to a great width, without its dragging as I have described, unless you alter the system. If you keep the present dish, you must have a narrow wheel, or it is rubbing; but if it is a straight axle, it ought to be as wide as that where there is no more friction, and then the wide wheel will not do half the mischief that the coach-wheel does. The present stage coach-wheel will do a great deal more mischief, working as it does, than if it had been perpendicular.

Are you to be understood that in no state of the road a wide wheel such as you have described would do injury to the road?—A wide wheel will do a partial injury, but not one quarter of that which it would do if it were narrow.

What sort of injury will it do?—It will tend to crush the pebbles and wear them, but that will be very trifling indeed; if you have a hundred weight upon a wheel of an inch wide, and a hundred weight upon a wheel of two inches wide, that one of an inch wide will break ten times as many pebbles as the other; every inch it goes will break stones; a wide wheel does away the injury.

You are aware that in the carriages that run at present on the common roads the wheels do not run in the same track, in the event of having wheels with the tires four inches wide, do you think it would be better that the tire of the hind wheels should run in the same track or a different track?—For the Carriage making one turn only, it is easier for the wheels to go on the same track; but if you wish to take the average of the duty, they never ought to go in one track.

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You think in the Steam Carriages that the tire of the hind wheels should go in different tracks?—Yes; the one produces a burr, and the other smooths it down.

Will the carriage run so easy?—No; it would for one turn; but in the course of time, going every day backwards and forwards, the work will be done easier.

You think the tire may be extended to almost any width; what is the width which you think a Steam Engine travelling rapidly ought to have?—It depends upon the weight they have to carry; but if you draw a conclusion from the Coaches carrying four tons on two-inch wheels, you might, with a great deal of convenience to the Engine, make them six; but a six-inch wheel would not break one-tenth part of the stones which a two-inch would.

You see no objection to a Steam Carriage, intended to travel fast with passengers, which may weigh as much as a coach and four with its horses, having a six-inch tire?—No; I know it is condemned by people in general; but I have never heard, nor have I seen, any reason for its being condemned.

The wheels being wide and being cylindrical, with their axle horizontal, supposing you were to double the diameter, or to increase the diameter considerably of a wheel six inches wide, would it go more easily for the road?—It would go easier for the machine; but then there must be a wheel of double the width, and that would be loading the machine in going up hill with an unnecessary weight; but that would ease the road; it will have a longer bearing on the ground; there would not be so quick a circle.

With respect to the road, there would be a considerable advantage?—Yes, for it is a larger arch.

With respect to the Engine, would there be any other disadvantage but the additional weight?—No; I do not know any material objection except that, and that would throw the Engine very high; it would be top heavy. I do not think it would be convenient to make wheels above six feet.

Can you state the weight of your Engine as compared with the weight of the present Engine?—I will furnish an answer to that question.

Do you conceive that your Engine, of which you have produced a plan, is as applicable to Carriages on roads as to the propelling Engines at sea?—Yes, that is one object I have in view, and for agricultural purposes, for ploughing, and every other purpose.

Have you ever calculated what the weight of a Carriage would be with one of your Engines?—Yes; I am looking to see the necessity of the doing away with the supply of water that I have done away with; but in dispensing with the water I shall save three-quarters of the fuel; every time we double the force of Steam we save seventy-five per cent. upon it. This Engine, I conceive, will not take one quarter part of the fuel; one charge of water will do for a month. I have just taken out a patent for my Engine.

Do you condense with a sufficient rapidity to take from the piston the pressure of the returning steam?—Yes; there was an Engine which had been working with high Steam and one of my boilers, and the cylinder was inclosed with brick-work, to keep off the external air; while I was abroad they took down the brick-work, and set it at a distance from the cylinder of four or five inches, and turned the draught from the fire round the cylinder to keep it off, and from that made more than sixty per cent. difference in the fuel; if the Engine was doing forty millions to a bushel of coals before, it then did sixty-three millions, and they burnt five bushels of coals to keep the cylinder hot; if they had put that under the boiler, it would have done forty millions, as before; but in putting in five bushels round the boiler, it did three hundred and fifty-six millions; then the difficulty was to know how it would make that difference; I could not at first make it out; however it turned out afterwards how it was, and it was the steam; when coming in upon the piston, the cold sides of the cylinder took out a part of the heat; these are single Engines; the steam is returned under the piston upon the Engine going that stroke again; the cold sides of the cylinder caused a dew by the steam; the steam was expanded to full four times the space; by the time it had gone a quarter part it was shut; then it was expanded; it was entirely cooled by itself; but when it came to touch the cold sides of the cylinder, it hung about them like a dew; the moment there was a communication to the condenser, that instant it expanded, and it threw itself into a second stroke; the next stroke threw that heat again into the side of the cylinder, the weight of the cylinder was about six tons; if it had taken out one degree each time, that would have taken out more than the Engine burnt. There is a clear proof how quick cold will condense.

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Are there not Steam Engines in which the cylinder is within the boiler?—Yes; those are commonly used now in the high-pressure Steam Engines.

Have you ever considered what toll should be charged upon Steam Carriages, assuming that a Steam Carriage of 40 cwt. is equal to four horses, and does no more damage than four horses would do upon a road?—I should judge that there would be no need to fix them heavier than just to pay for repairing the road, whatever it may be; people are not to get their maintenance out of roads; and if the Steam Carriages do not injure the roads half as much as a common carriage, they should not pay half so much.

You do not suppose that a Steam Carriage weighing four tons would do more injury than a horse carriage?—A Steam Carriage with the same weight would do nothing like the same injury as a horse coach, for they have narrow wheels and these have not; and there are no horses' feet.

Your opinion is that there should not be a higher toll charged upon those Steam Carriages than upon a coach drawn by four horses?—If the toll is charged according to the injury done to the road, it would be not more than half.

Do you conceive there would be any difficulty in applying Steam Carriages to the present roads with the present ascents?—Under the present circumstances there is a difficulty; it is a question whether it shall go over the road, for the weight is too great; but if the weight is done away, and three to one in power added, it will be possible to do it, and I have no doubt it will be effected on my principle.

You think that the Steam Engines already prepared would go on the common roads?—They are between sinking and swimming at present, and I think they will swim; I think that the improvement is effected, and that they will do.

Would it not lighten the weight of Engines if you had fixed stationary Engines to pump gas, fifty atmospheres for instance; and shift the vessel containing it at each stage?—We do not want air or gas.

Something that has a power to drive?—A vessel that weighed that would be so heavy, it would not carry its own weight; the vessel it was compressed into would be of very considerable weight; a cubic inch of water will fill a cubic foot.

In the application of your power to a Steam Carriage, do you suppose there would be less danger of bursting than at present exists?—Yes; this cannot burst; that is prevented.

Have the goodness to state your reason?—There are five separate cylinders, the one encircled in the other; and if the boiler, or the inner circle burst, there are four other circles that might take the pressure, one after the other, before it can externally explode, which outer circles are never heated; and the boiler can never be heated or low, because the steam that is made use of by the Engines is returned every stroke into the boiler, and provided an Engine is tight, it may work for ever without a fresh supply of water.

What height would the shaft be, as applied to your Steam Carriage?—It does not require to be higher than a common Steam Carriage.

Have the Steam Carriages that now ply on the roads a shaft?—No; they get the fuel through a fire door, but it will answer best to fill through; you get considerable advantage. In the first place, you have a less boiler; by having a less boiler it is lighter; it is much stronger by getting a greater pressure; there is 75 per cent on the fuel; if you take the average of the advantages, it will save daily nearly ten to one on travelling Engines.

That will render it necessary to have a chimney in a Steam Carriage?—A chimney is not necessary for the sake of draught if there is a forced draught; the Engine, of which I have produced a drawing, is made for a ship, where we are not bound to height, but five or six feet would be quite sufficient.

Do you apprehend that in your Engine there would be any noise from friction, so as to alarm horses?—No more than in any other Engines; there is no more noise, whether the steam is generated in the same way or how it is conducted, makes no difference.

With what would you work?—With coke; that would be the most convenient.

Do you think the road would suffer less damage from the Carriage itself containing the Engine conveying the passengers, or conducting another Carriage intended to convey passengers?—I think it better to have separate Carriages for the roads, as well because there is less weight upon the wheels; the weight would be more equally divided on the four wheels; but there will be six wheels in a general way I think. The two fore wheels will bear but very little weight.

Might not a single truck wheel do for that?—It would not be steady.

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Mercurii, 17^o die Augusti, 1831.

CHARLES D. O. JEPHSON, ESQUIRE,

IN THE CHAIR.

Mr. *Richard Trevithick*, again called in; and Examined.

ARE there any additional observations you wish to make to the Committee?—
There are. I was asked what I had performed, and what was my opinion as to whether Steam power could be made useful on common roads in general, and the difference in effect between broad and narrow wheels on such roads, respecting their breaking up or settling down the surface, and what farther advantages I might expect from my late improved Steam Engine. In answer, I beg to say, in 1804 I invented and introduced the high-pressure Steam and locomotive Engines, and also, in 1813, invented the Iron Tanks and Buoys for His Majesty's Navy. In 1814 I was engaged by the Spanish Government to construct in England nine high-pressure Steam Engines, and a mint, with pump-work, and every thing complete for draining the great mines of Paseo, in Peru: they weighed 500 tons, in 20,000 pieces, the boilers each of six tons weight, all in single plates, and the cylinders each in six pieces, all carried up the mountains on mules' backs, and put together on the spot, by which the mines were effectually drained, the ores wound up, stamped, smelted and coined; they remained in full work until the Spanish army retreated through the mines before the Patriots, and on their retreat broke the Engines, and threw them into the Engine pits. For a Report of my progress in Peru, see the first Number of the Geological Transactions of Cornwall, copied from the Lima Gazettes. In reply to the questions put to me by the Committee of the House of Commons, respecting the probable progress of Steam power for locomotive purposes, I beg to say, on Railroads they have been proved to be useful to a certain extent, but are still defective, on account of their great weight of machinery and water, and the difficulty of getting water at all times, also a want of permanent safety against explosion; but, from a late improvement of mine, these obstacles are now removed, and when these late improvements are combined with my former locomotive Engines, they can be constructed so light as to travel at almost any speed, and thousands of miles, without a supply of water, and the risk of exploding is reduced to an impossibility, with a saving of considerably above fifty per cent in fuel; all those improvements will appear in my statement hereafter. Travelling on common turnpike roads would be by far the greatest national advantage, but which, on the present plan, never can be accomplished, because the difficulties of getting a supply of water, and the inequalities of the surface of the roads, will always, under these circumstances, prevent the limited power to ascend the hills; and this objection is irremovable, because, as the power at present increases, the weight increases in nearly the same ratio. At the present moment we have a proof of this, from the Engines travelling on common level roads being as nearly as possible in equilibrium, their power just capable of running their own weight at a fair speed, on a level surface; and they now only wait an increase of their power, independent of weight, to accomplish their general adaption to every purpose, both on the road and also to agriculture; and as the expense of fuel bears so small a proportion to horse labour, the removal of the present objections would accommodate their general use to unlimited advantages that the public are anxiously in search of. As the axles of Steam Carriages require to be straight, and the wheels perpendicular, there remains no objection to employing any width of wheel that the Road Inspectors require, which, to a certain extent, will reduce the resistance, instead of increasing it. It is my opinion, that all wheels now in use on common roads are much too narrow; but this ought to be accommodated to the materials that the road is formed with: for instance, narrow wheels on an iron road do not yield to the pressure of the weight, but keep themselves perfectly horizontal, and do not pulverize; but every Macadamized road, more or less, is subject to this inconvenience, and the narrower the wheels, the greater mischief is done to the road, and more resistance is given to the horses. The usual notion, that wheels grind the road, is wrong; if any difference, it is the roads grind the wheels, the

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road-material being generally the harder of the two ; but the roads are injured by the wheels crushing the stone, by a narrow surface bearing on small points, or on single stones, the tenacity of which will not support the weight under narrow wheels ; under wide ones, they would sustain no injury, because the wide wheel reduces its weight on each inch of surface in contact with the road, as the number of surface inches is increased by its additional width, and settles down the road firmly, and gives each stone a side support also, therefore by double the bearing on the road, half the weight is taken off from every bearing surface inch, and that in addition to the side support, by being bedded firmly, a wide wheel will, I have no doubt, save four out of five, if not nine out of ten stones that are crushed at present, and reduce the road expenses in the same proportion ; but while the fancy of having carriage-wheels out of upright with crooked axles is continued, wide wheels would be a serious objection ; the inside and outside of the wheel being of different diameters, and going different speeds, must cause an increase of load to the horses, because their rubbing on the road and tendency to twist move the stones out of their bed in the road, and, instead of bedding them firmly, has the contrary effect ; another great evil arises from the use of narrow wheels, they sink lower into the road, and the road being in part elastic, whatever that may be, is a resistance added to the horses according to its perpendicular rise and fall ; the passing over sand or snow gives a proof of this on a larger scale, and wide surfaces will bed snow, and form a firm road, while narrow surfaces would defeat the effect. Another proof of wide surfaces bedding firmly is seen in Cornwall, where the mills for stamping the ores in the mines have Steam Engines in constant work, lifting twelve inches high iron stampers of three or four hundred weight, of about seventy inches of bearing ; at the bottom surface these form their own bed, which is about a foot thick of Macadamized stones, and are an everlasting foundation, though the stamps pulverize at the surface as fine as sand. It would be advisable for the fore and hind wheels of Carriages to run about half the track out of a line from each other, because the bank that is formed by the fore wheel would be rebedded by the hind one, and the leveller the road is kept, the less the jolts, and of course the shoaler will be the ruts, while the surface of the road remains sound, and even the wear is scarcely any thing, and the crushing cannot take place but in a very small degree ; because the small gravel binding uniformly with the larger stones, supported on every side, brings the whole surface into uniform contact with the wheel, in which state but very little injury can be done ; but when uneven or broken, the loose stones roll about without a support, and kept so by narrow wheels, they independently receive the whole weight of the wheel, and instead of being bedded down are crushed to powder. The unnecessary resistance given to Carriages and wear of roads by narrow wheels far exceeds all conception. As a proof that locomotive wheels will not injure the roads by slipping round, I give you the copy of a Report printed on the performance of the locomotive Engines on the Manchester Road for the premium. The following calculation, founded on the reported result, was made by Mr. Vignoles and Mr. Price, of Neath Abbey. The maximum number of strokes was 142 per minute, while 440 yards were traversed in 43 seconds ; diameters of wheels 50.1 inches, circumference 157.4 inches ; 157.4×142 inches, equal to 621 yards, being the velocity per minute of the circumference of the wheel, or 21 miles and 300 yards per hour ; then as 60 seconds is to 621 yards, so is 43 seconds to 445 yards. Thus, the calculated distance of the run, considering the wheel as a perambulator, agrees within five yards with the space actually passed over, and this difference might arise from the most trifling inaccuracy of noting the time, a quarter of a second at each end being sufficient to produce this discrepancy, so that it might fairly be concluded there was no slipping of the wheels at a velocity of nearly 22 miles an hour with a load. If wheels will not slip round on iron roads, there can be no doubt but that they will be firm on common roads. A Steam Carriage never needs the wheel chained, or to be still in going down hill, because if a throttle cock is put between the discharge pipe and the piston, it cannot go down hill any faster than the Steam is permitted to make its escape from before the piston, and if required would stand still instantly. Below is stated the commencement of both my high pressure and locomotive Steam Engines, with the advantages derived from them. Since 1804, at which time I invented and erected this high pressure Engine, up to the present time, little improvement has been made in addition to my own. The first locomotive Engine ever seen was one that I set to work in 1804, on a rail-road at Merthyr Tydvil, in Wales, which performed its work to admiration, a correct copy of which is now in general

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general use on the rail-roads ; the advantages gained by this improvement was a detached Engine, independent of all fixtures, working with five times the power of Boulton and Watt's Engine, without condensing water, and the fire inclosed in the boiler surrounded with water, and a force draught created by the Steam for the purpose of working on the roads without a high chimney; and from this was copied all the boilers for Navigation Engines, which without it could not have been available; this being independent of brick-work, light, safe from fire, and occupying little room. In March 1830, Davies Gilbert, Esquire, then President of the Royal Society, wrote a Treatise on the improvement made in the efficiency of the largest Steam Engines in the world, then working in Cornwall, in which he states, that in 1798, he made trial of Boulton and Watt's Engines in that county, and found the average duty performed in the mines was 17,621,000 lbs. lifted one foot high with one bushel of coals ; and in 1830, when he published his Treatise on the improvements of the Steam Engines in the Cornish mines, he says, that the improvement was so great that a duty of 75,628,000 lbs. lifted one foot high, with the same quantity of coals, was then performing in the mines ; that when compared with the duty done in 1795, the improvement exceeded Boulton and Watt's Engines, as 3.865 to 1, or 27 to 7 nearly ; and exceeded the standard of the old atmospheric Engines, that were at work in 1778, as 10.75 to 1, (at present some of the best Engines have performed a duty of 90 millions with a bushel of coals,) and the result of this great improvement has been, that not one Engine on Boulton and Watt's plan remains at work in Cornwall ; and it is acknowledged by all the Cornish Miners that this improvement solely has been the salvation of their deep and extensive mines, without which the mines could not have continued to work ; but from this increase of power and speed, a duty and saving both in fuel and size of four to one, which has caused the saving of coals in the Cornish mines alone to exceed one million sterling, and a constant saving of above one hundred thousand pounds per year. The saving of fuel in theory, by working with high Steam, is 75 per cent. every time that the elasticity of the Steam is doubled, because double the quantity of coals doubles the pressure, and increases the bulk three-eighths, and by working this Steam expansively three-eighths more are gained, and not only theory but practice proves that gain on all the Cornish Engines ; the usual height of steam is sixty pounds above the atmosphere, but if the boilers could be made safe against explosion and work with much higher steam, the advantages would almost exceed limit ; the accidents that have taken place by explosion, do not appear to be from overloading the safety valve, but from overheating the boiler, because low pressure boilers have often exploded, and this generally takes place immediately on setting the Engine to work ; when the boiler is under water gauge it must be red hot, and while the Engine is standing the water in the boiler is still, but the moment that the Engine starts, the sudden escape of steam from the boiler to the cylinder causes a great ebullition of the water, and splashes it over the red hot sides, which instantaneously generates a superabundant quantity of steam more than the strength of any boiler, however strong, can sustain, because one pound of melting iron will boil three pounds of water, therefore the red hot tubes of a boiler to be suddenly cooled by water splashing over them, would immediately generate a hundred times as much steam as the space of the boiler would contain, therefore while the feed is so uncertain and the height of water fluctuates so much in the boiler, no permanent safety can be relied on, however light the safety valve may be loaded, or strong the boiler may be ; boilers fed with salt or even foul water are dangerous, they are often incrustated with salt, repeatedly heated red hot and quickly reduced in substance and strength. To prevent the salt accumulating, a constant stream of boiling water is ejected from, and cold water in its stead injected into the boiler, which occasions a constant fluctuation in the height of water in the boiler, and requires a constant caution in the Engineer to prevent mischief. A proof that boilers do not explode from the regular working pressure of steam, is by the portable gasholders of one sixteenth of an inch thick and ten inches diameter being regularly charged with thirty atmospheres, or 450 pounds to the inch without accident, and though this pressure is not one-half the pressure that the theory of the strength of iron would bear, yet boilers have often exploded, though the safety valves have never been loaded with one-eighth part of the pressure of the gasholders, or one sixteenth of the pressure of the theory of the strength of iron in proportion to the strength and diameter of boilers, when compared with the gasholders ; therefore perfect safety never can be relied on under the present regulations. To remove these serious evils, save fuel ; and give a considerable increase in

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the power of Engines with less space and weight, I have made an entire new Engine, both in principle and arrangements, the fire-place, boiler and condenser are formed of six wrought iron tubes standing perpendicular on their ends, encircled the one within the other for the purpose of safety, and to occupy little room, also for keeping the boiler to one constant gauge, with fine distilled water, permanently working without loss, by condensing the steam and never suffering it to escape out of the Engine, but returning it from the condenser back again into the boiler every stroke of the Engine by a force pump, and where an Engine is perfectly tight it would work for ever without a replenish of water; but to supply leaks a small evaporating apparatus is used for supplying the deficiency with distilled water, which effectually prevents any fluctuation in the height of water in the boiler or collecting sediment, and an impossibility of ever getting the boiler red hot, there being no space for the water to fly to out of the boiler but into the condenser; and this is so small, that if by any means the force pump did not return the water regularly from the condenser to the boiler, the space in the condenser, by taking one inch in depth of water out of the boiler, would fill and glut the condenser so, that the Engine would stand still, and, as the water cannot diminish, it does not require a large quantity of water, or water space in the boiler, so necessary in other Engines, to guard against fluctuation in the feed, and prevent the boiler becoming red hot. The boiler being considerably less, the strength and room will be increased, and, never getting hot, the Engine might be worked with much higher steam; if so high as the gasholders are charged with, the theory gives a saving of fuel, weight and room over low-pressure Engines of sixteen to one, without a supply of water. I state this, to show the probable advantages that will arise from this new Engine. For my Engine to be one hundred horse power, to raise sufficient Steam, the fire tube must be three feet diameter, which would give the boiler a diameter of three feet eight inches, and that a half inch thick, according to the theory of the strength of iron, would sustain a pressure of 1,736 pounds to the inch, which is four times as great as the gasholders are charged with, and thirty-two times the pressure that the high-pressure Engines work with at present, which is still farther proof that the explosions have been solely occasioned by the boilers being under water gauge, and heated red hot. If after boilers have been forced on their trial by a cold-water pressure, to stand ten times the pressure that they are to be worked at, and a boiler should happen to explode, the shock would be first received by the next surrounding tube, and so on for six successive surrounding tubes; each space between the tubes would admit the Steam to escape gently up the chimney without harm, and the outside tube that encircles the whole, might be made of three quarters of an inch thick, so that it would put injury from explosion beyond possibility. The arrangement of this new Engine embraces every advantage that can be wished for; safety, saving of fuel, lightness, little room, cheapness, simplicity, and nearly independent of water, it can be made applicable to any purpose, and much more effectual than horse power, the first cost of erection far less than a quarter the cost of horses; for the duty performed, independent of the difference of expense between coals and horse-feed, because a one-horse Engine will, by constant work, perform the work of four horses every twenty-four hours. For breaking up and tilling large commons very little establishment will be required. Another great national advantage will be gained, by the whole of the kingdom being abundantly supplied with fresh fish, as it will be in the power of every fishing-boat to get a small Engine, and bring fish to market all round the Coast while fresh, independent of wind, this may be carried by locomotive Engines, in a few hours, to the interior of the country; besides, every merchant ship will be propelled by Steam, as an Engine of ten tons weight on the deck, occupying very little more room than a ton cask, would propel a ship of 500 tons five miles per hour with sixpence worth of coals, and will also pump the ship, weigh the anchor, and take in and out the cargo. The principles of the leading power being matured, all the applications will soon follow.

Davies Gilbert,
Esq. M. P.

Davies Gilbert, Esquire, a Member of the Committee; Examined.

HAVE you paid any attention to the general nature and advantages of wheels and springs for Carriages, the draft of cattle, and the form of roads?—I paid considerable attention to it during the sitting of a Committee of this House about Twenty years ago, of which Sir John Sinclair was Chairman, and I then drew up some Observations on the nature of wheels and springs on roads, which, with some alterations, I printed in the Eighteenth volume of the Journal of Sciences, and which I would

I would beg to deliver in to the Committee as the result of my observations on the subject.

[*The same was read as follows:*]

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" Taking wheels completely in the abstract, they must be considered as answering two different purposes.

" First, they transfer the friction which would take place between a sliding body and the comparatively rough uneven surface over which it slides, to the smooth oiled peripheries of the axis and box, where the absolute quantity of the friction as opposing resistance is also diminished by leverage, in the proportion of the wheel to that of the axis.

" Secondly, they procure mechanical advantage for overcoming obstacles in proportion to the square roots of their diameters, when the obstacles are relatively small, by increasing the time in that ratio, during which the wheel ascends; and they pass over small transverse ruts, hollows or pits, with an absolute advantage of not sinking, proportionate to their diameters, and with a mechanical one as before, proportionate to the square roots of their diameters consequently, wheels thus considered, cannot be too large; in practice, however, they are limited by weight, by expense, and by convenience.

" With reference to the preservation of roads, wheels should be made wide, and so constructed as to allow of the whole breadth bearing at once; and every portion in contact with the ground should roll on it without the least dragging or slide; but, it is evident from the well-known properties of the cycloid, that the above conditions cannot unite unless the roads are perfectly hard, smooth and flat; and, unless the felines of the wheels, with their tires, are accurately portions of a cylinder; these forms, therefore, of roads and of wheels are the models towards which they should always approximate.

" Roads were heretofore made with a transverse curvature to throw off water, and in that case it seems evident that the peripheries of the wheels should, in their transverse sections, become tangents to this curve, from whence arose the necessity for dishing wheels, and for bending the axes, which contrivances gave some incidental advantage for turning, for protecting the nave, and by affording room for increased stowage above. But recent experience having proved that the curved form of roads is wholly inadequate for obtaining the end proposed, since the smallest rut intercepts the lateral flow of the water; and, that the barrel shape confines Carriages to the middle of the way, and thereby occasions these very ruts; roads are now laid flat, Carriages drive indifferent over every part, the wear is uniform, and not even the appearance of a longitudinal furrow is to be seen. It may, therefore, confidently be hoped that wheels approaching to the cylindrical form will soon find their way into general use.

" The line of traction is mechanically best disposed when it lies exactly parallel to the direction of motion, and its power is diminished at any inclination of that line in the proportions of the cosine of the angle to radius. When obstacles frequently occur, it had better perhaps receive a small inclination upwards, for the purpose of acting with most advantage when those are to be overcome. But it is probable that different animals exert their strengths most advantageously in different directions, and therefore practice alone can determine what precise inclination of this line is best adapted to horses, and what to oxen. These considerations are, however, only applicable to cattle drawing immediately at the Carriage; and the convenience of this draft, as connected with the insertion of the line of traction which continued, ought to pass through the axis of the wheels, introduces another limit to their size.

" Springs were in all likelihood applied at first to Carriages, with no other view than to accommodate travellers. They have since been found to answer several important ends. They convert all percussion into mere increase of pressure; that is, the collision of two hard bodies is changed by the interposition of one that is elastic, into a mere accession of weight. Thus the Carriage is preserved from injury, and the materials of the road are not broken: and, in surmounting obstacles, instead of the whole Carriage with its load being lifted over, the springs allow the wheels to rise, while the weights suspended upon them are scarcely moved from their horizontal level. So that, if the whole of the weight could be supported on the springs, and all the other parts supposed to be devoid of inertia, while the springs themselves were very

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long, and extremely flexible, this consequence would clearly follow, however much it may wear the appearance of a paradox, that such a Carriage may be drawn over a road abounding in small obstacles without agitation, and without any material addition being made to the moving power or draft. It seems, therefore probable, that under certain modifications of form and material, springs may be applied with advantage to the very heaviest waggons, and consequently, if any fiscal regulations exist, either in regard to the public revenue or to local taxation, tending to discourage the use of springs, they should forthwith be removed.

“ Although the smoothness of roads, and the application of springs are beneficial to all Carriages, and to all rates of travelling, yet they are eminently so in cases of swift conveyance, since obstacles when springs are not interposed, require an additional force to surmount them beyond the regular draft, equal to the weight of the load multiplied by the sine of the angle intercepted on the periphery of the wheel between the points in contact with the ground and with the obstacle, and therefore proportionate to the square of its height; and a still further force, many times greater than the former when the velocity is considerable, to overcome the inertia, and this increases with the height of the obstacle, and with the rapidity of the motion both squared. But, when springs are used, this latter part, by far the most important, almost entirely disappears, and their beneficial effects, in obviating the injuries of percussion, are proportionate also to the velocities squared.

“ The advantages consequent to the draft, from suspending heavy baggage on the springs, were first generally perceived about forty years since on the introduction of mail coaches; then baskets and boots were removed, and their contents were heaped on the top of the Carriage. The accidental circumstance, however, of the weight being thus placed at a considerable elevation, gave occasion to a prejudice, the cause of innumerable accidents, and which has not, up to the present time, entirely lost its influence; yet a moment's consideration must be sufficient to convince any one, that when the body of a Carriage is attached to certain given points, no other effect can possibly be produced by raising or by depressing the weight within it, than to create a greater or less tendency to overturn.”

The extensive use of waggons suspended on springs, for conveying heavy articles, introduced within these two or three last years, will form an epoch in the history of internal land communication not much inferior perhaps in importance to that when mail coaches were first adopted; and the extension of vans, in so short a time, to places the most remote from the Metropolis, induces a hope and expectation that as roads improve, the means of preserving them will improve also, possibly in an equal degree; so that permanence and consequent cheapness, in addition to facility of conveyance, will be distinguished features of the M'Adam system.

I have made some further remarks, which I would beg to deliver in also, tending to point out particularly the advantage of steam conveyance when the rate of travelling is great: I would beg to add, that it appears to me extremely difficult to lay down any general rule which would be applicable to all situations and all roads, inasmuch as they vary with the nature of the materials: that up to a certain weight, proportionate to the corresponding width of the wheel, it is probable that the injury to any road may be very little, but that beyond a certain weight, compared again with a corresponding breadth of the wheels, the materials would be entirely crushed and the road totally destroyed; therefore it follows, that even on all roads there must be a limit to the weight of Carriages, as it is quite impossible that a wheel of enormous breadth could bear uniformly on all its surface. For instance, where trains of artillery are drawn over roads, the excess of their weight beyond what materials are capable of sustaining, has been found sufficient for grinding them to powder. “ The slow conveyance of heavy weights may perhaps be effected by steam on well-made and nearly level roads, so as to supersede the use of horses; but steam power is eminently useful for producing great velocities. It was last year determined by the Society of Civil Engineers, after much inquiry and discussion, that the expense of conveying Carriages drawn by horses was at its minimum when the rate of travelling equalled about three miles an hour, and that expense increased up to the practical limit of speed, nearly as the velocity; including the greater price of horses adapted to swift driving, their increased

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increased feed and attendance, the reduced length of their stages, and, with every precaution, the short period of their services; on the contrary, friction being a given quantity as well as the force requisite for impelling a given weight up a given ascent, the power required for moving Steam Carriages on a Railway remains theoretically independent of its speed, and practically increases but a very little, in consequence of resistances from the atmosphere, slight impacts against the wheels, inertia of the reciprocating piston, &c. The expenditure of what I have termed Efficiency, is as actual force multiplied by the velocity, and the consumption of fuel in a given time will be in the same proportion, but the time of performing a given distance being inversely as the velocity, the expenditure of fuel will theoretically be constant for a given distance, and very nearly so in practice. The power requisite for moving bodies through water is in the opposite extreme; here, the mechanical resistance of the fluid increases with the square of the velocity, as do the elevation of the water at the prow and its depression at the stern. The oars or paddles must therefore preserve a constant ratio to the velocity of the vessel; and the force applied will consequently vary as the squares of the velocity, and the expenditure of Efficiency being as the force multiplied by the velocity; the consumption of fuel will be as the cube of the velocity in a given time, or as the square of the velocity on a given space; and I have ascertained from the records of voyages performed by Steam vessels, that the law is nearly correct in practice: hence the great power required for such Steam vessels as are constructed not merely for speed, but also to set at defiance the opposition of winds and seas; while, on the contrary, a very small power will be found sufficient for moving ships of the largest dimensions through the water, at the rate of two or three miles an hour, when their sails are rendered useless by continued calms."

Mr. *Nathaniel Ogle*, called in; and Examined.

WHAT is your profession?—I have no profession; I am pursuing the introduction of locomotive Engines on common roads.

Have you invented any Carriage of this description actually now in practice?—Yes, partly so.

Have you run your Carriage for any length of time on public roads?—About 800 miles, or rather more, over roads of various descriptions, and up lofty hills.

Will you describe generally the nature of your Carriage, and of any improvements you have made, since you first turned your attention to the subject?—The object in all locomotive vehicles is to obtain a mode of generating steam that shall give the command of a sufficient power, under all varying circumstances to be met with on the common roads. We have obtained that desideratum, by combining the greatest heating surface in the least possible space, with the strongest mechanical force, so that we work our present boiler at 250 lbs. pressure of steam on the inch, with the most perfect safety. Our experimental vehicle, weighing about three tons, or rather more, we have propelled from London to Southampton, and on the roads in the vicinity of Milbrook, at various speeds. The greatest velocity we obtained, over rather a wet road, with patches of gravel upon it, was between 32 and 35 miles an hour, and might have been continued under similar circumstances; and we could, on a good road, have increased that velocity to 40 miles. We have ascended a hill with a soft wet bottom, rising one foot in six, at rather a slow rate. We have ascended one of the loftiest hills in the district near Southampton, at $16\frac{1}{2}$ miles an hour. We have gone from the turnpike-gate at Southampton to the four-mile stone on the London road, a continued elevation, with one very slight descent, at a rate of $24\frac{1}{2}$ miles an hour, loaded with people. The locomotive vehicles used on the Liverpool and Manchester Railroad would not go at three miles an hour on a common level road, and would not ascend any hill; and on account of the diameter of their boilers, cannot, scientifically speaking, be considered safe. The vehicle is under perfect control in every respect. No accident from explosion can take place. We have had whole families of ladies, day after day, out with us in all directions, and who have the most perfect confidence. We are now upon the point of establishing a factory where these vehicles will be made in numbers; and a great many are already required by coach-proprietors, carriers of merchandize, and others, for their use on the public roads. Railroads, excepting in very peculiar situations, are behind the age; and it is my decided opinion, that those who embark capital in constructing them will be great losers.

Will you describe the form of your boiler?—The base of the boiler and the summit

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are composed of cross pieces, cylindrical within, and square without; there are holes bored through these cross pieces, and inserted through the hole is an air tube. The inner hole of the lower surface, and the under hole of the upper surface, are rather larger than the other ones. Round the air-tube is placed a small cylinder, the collar of which fits round the larger aperture on the inner surface of the lower frame, and the under surface of the upper frame-work. These are both drawn together by screws from the top; these cross pieces are united by connecting pieces, the whole strongly bolted together, so that we obtain in one-tenth of the space, and with one-tenth of the weight, the same heating surface and power as is now obtained in other and low pressure boilers, with incalculably greater safety. Our present experimental boiler contains 250 superficial feet of heating surface in the space of 3 feet 8 inches high, 3 feet long, and 2 feet 4 inches broad, and weighs about 800 weight. We supply the two cylinders with steam, communicating by their pistons with a crank axle, to the ends of which either one or both wheels are affixed as may be required. One wheel is found sufficient, excepting under very difficult circumstances, and when the elevation is about one foot in six, to impel the vehicle forward.

Have you taken out a Patent for this invention?—We have, in the name of William Alltoft Summers and Nathaniel Ogle.

You state that the weight of that Carriage is about three tons or more, is that independent of the necessary load?—That will include the coke and the water, but not the passengers.

Have you any peculiar means for rendering explosion impossible?—Yes; the cylinders of which the boilers is composed are so small as to bear a greater pressure than could be produced by the quantity of fire beneath the boiler, and if any one of these cylinders should be injured by violence, or any other way, it would become merely a safety valve to the rest. We never with the greatest pressure even burst, rent, or injured our boilers, and has not once required cleaning after having been in use twelve months.

Is the connexion between your different cylinders so perfect, that there is no danger of the steam collecting in one particular point of it?—There is a perfectly free communication, and not the least danger to be apprehended.

Have you one or two safety valves?—Two.

At what pressure do you usually work your Carriage?—Two hundred and forty-seven pounds on the square inch of the boiler, but we have worked it at a greater pressure than that.

To what pressure do you usually weight your safety valve?—Two hundred and forty-seven pounds.

Then you travel always on the lift?—Yes; we are always glad to see our steam blowing off, and when our fire is even moderately good it is always blowing off, even up the steepest hills, proving an excess of power.

Does that create any annoyance to passengers along the road?—None whatever; the waste steam is carried round a double casing of the fire-place, then brought over the surface of the fire where some portion is consumed, and the rest passes off through a very small chimney in an aeriform state.

Do you use coal or coke?—Soft and good coke which easily ignites and burns rapidly.

You have not any annoyance then to passengers from smoke from your Carriages?—None whatever; there is no appearance of smoke except on lighting the fire with wood, which is necessary to ignite the coke.

That takes place before you start?—Yes; but even that will not be necessary when every thing is arranged.

You state that your Carriage is under the most perfect control?—Perfect.

Supposing you were going at the rate of ten miles an hour on a level road, in what number of feet do you suppose you could entirely check the Carriage?—It would be difficult to state precisely the number of feet, but certainly in a less space than you could stop a pair of carriage horses going with the same weight attached to them. I have no hesitation in saying, that a steam vehicle is safer in every respect than one with horses, that it is under more complete management at the same velocities and with the same weight, that it is more easily controlled, and that none of the accidents from fractious horses can take place with Steam Carriages.

Do you find that horses are generally frightened by passing your Carriage?—Very few indeed, persons usually alarm their own horses (the animal being quickly subject

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subject to alarm) either by dismounting, or patting them, and thus anticipating apprehension.

What rate of toll has been charged on your Carriage in the neighbourhood of Southampton?—None, whatever. I have paid near London, when trying experiments, a shilling or two, and I made no inquiry. I remember, going out of London, throwing one man a shilling, and another two, being too much occupied to trouble myself about the matter.

You pass through turnpikes in travelling round Southampton?—Yes.

What is the reason they have not charged you?—I do not know, unless they had the good sense to see that we rather do good to the road than injury.

Do you know on what authority they levy tolls on Carriages?—I know of only two instances in which they have been levied on Steam Carriages, one at Hammer-smith Bridge, and the other at Cambridge Heath, near Hackney.

If toll collectors at Southampton abstain from demanding tolls, is it not because they had not authority to demand them?—I do not know their motive.

You think that the toll collector is so interested in the good state of the road that he would abstain from demanding toll on that ground?—I think, that if they have contracted to keep the road in repair, they would be glad that Steam vehicles should run upon that road in preference to Carriages drawn by animals; because the wheels of Steam Carriages, if the tires are of a proper breadth, act as rollers.

Do you know whether the toll collectors in general, contract for keeping the road in repair?—I do not know.

Do you know any instance of it?—No, I do not.

Have you heard any complaint by contractors of the injury done to roads from your Carriages?—No.

Nor from the surveyors of roads?—No.

What is the breadth of the tires of your wheels?—About three inches.

Could you increase the tire of your wheels without inconvenience?—Certainly.

To what breadth?—With a given weight there might be given breadths, in my opinion a vehicle carrying four tons weight, the Engine itself weighing three tons, should have a tire about four inches and a half in breadth, a flat tire, not a round tire, and the wheels should be cylindrical. It is decidedly to the interest of Steam Coach proprietors to have the tires broad, as the wheels have a diminished tendency of sinking into the road.

Should they be increased according to the weights?—Yes; but I do not think that we have knowledge enough to speak precisely on that subject, and to go into minute details as to the exact breadth which should bear a given weight.

Taking either an increased or a diminished weight, what would be the increased or diminished breadth of wheels which you would recommend?—I am not prepared to answer that minutely.

Is it your opinion, that in case they exceed three tons weight, that wheels, three inches wide, improve the road, passing with the velocity they do?—Certainly; the velocity has nothing to do with the wear of the road.

How many wheels have you?—Our present Carriage has only three, so that the centre wheel rolls that portion of the road which has been cut up by the action of the horses' feet.

Is it of the same breadth as the two hind ones?—It is broader, being four inches and a half.

Is the centre wheel a guiding wheel?—It is.

What portion of weight is upon that as compared with the others?—That must vary a little, but generally about one-third.

Is yours a coach?—No, it is a treble-bodied phaeton.

How many passengers have you carried when you have gone at the rates you have described?—I think I have seen nineteen; weight is of no importance to a steamer.

Taking the weight of your Carriage, with the Engine, at three tons, what weight do you suppose that you could carry at the rates you have spoken of?—Between three and four tons, very well.

Besides its own weight?—Yes.

Doubling its own weight?—Yes; twenty people will weigh more than a ton and a half.

For what distance do you travel without taking in water?—We can increase our capability to a great extent; at present, we carry about seven hundred weight of water; it lasts about forty minutes; that depends on the quality of the road

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How much coke?—The quantity we carry is according to the distance we wish to go.

What weight of fuel would you think it necessary to take in, to go one of your average stages?—Three bushels.

How much does a bushel weigh?—That is difficult to answer, coke differs in its weight; the average weight is about forty pounds a bushel.

What proportion of injury do you think one of your Steam Carriages does to the road in comparison with the injury done by a Coach drawn by horses proceeding with the same velocity?—Not one-half; first of all they receive no injury from the feet of the horses; a horse must have something to hold by, and the action of a horse's foot is to scrape and dig up the ground. Vehicles drawn by horses of equal weight, have usually narrower wheels, which must increase the injury done to the road.

Are your wheels dished, or are they cylindrical?—Cylindrical, with flat tires.

What are the diameters of your propelling wheels?—We have generally used them about six feet; those we have now are about five feet six.

Have you changed the diameters from experiment, from finding the smaller diameter more convenient?—From finding some wheels with the spokes cut through, whether intentionally by the workmen, or from mere neglect, we could not tell; but they were merely reduced from six feet to five feet six.

For a Carriage calculated to carry eighteen persons, what would be the length, and what the breadth?—I think that our next will measure eighteen feet six; that is not so long as a Carriage with two horses; the breadth six feet nine inches between the wheels.

During the course of your experience have you met with any accident, such as the breaking of your machinery?—None whatever of any denomination; not one bolt, not one screw has ever given way, during a period of twelve months, and under circumstances which would have utterly destroyed any other Carriage, and very much to the surprise of engineers, who are sadly uninformed on all points relative to Steam Coaches, and have never advanced their success.

In the improvements you are now engaged upon in your Carriage, are they relative to the size and weights of the different parts, or merely in the conveyance of the goods and passengers?—They are more in improving slight details; the power we have, beyond all question, to propel vehicles of any weight, at any required velocity.

Have you made many experiments as to the size of your cylinder?—We have made several experiments.

In reference to the usual velocity you require, and the weight you have to carry, what do you find the most advantageous size of cylinder?—The larger the cylinder, certainly, the better; but were I to give definite answers to such questions, it would be giving too much information to those opposed to us.

What is the greatest weight that any Steam Engine you have ever built is capable of carrying ten miles an hour?—About three tons, in addition to its own weight. The majority of the London engineers treated our opinions, founded on the laws of nature and experiment, with contempt and ridicule, and were amazed at witnessing the vigour of our Engines, and the velocity with which we left the factory in Cable-street, Whitechapel, and proceeded towards Southampton.

Have you ever ascertained that that Carriage, when loaded, weighs six tons?—No, never.

What was the greatest weight you ever weighed?—We never weighed it at all. I can only speak from conjecture. I have seen nineteen persons on it, and seven cwt. of water.

At what rate did you travel with that load?—We went with that load up a considerable ascent, about thirteen miles from Southampton, I should think, about from a quarter to half a mile. We travelled about ten miles an hour.

How did you ascertain that rate; did you make accurate observations at the time?—We know pretty accurately, by observation, at what rate we are going; but we can ascertain with the greatest minuteness, by knowing the number of revolutions made by a wheel of a certain diameter.

When you were conveying those nineteen persons, how many horse power do you suppose was exerted by your machinery?—Nearly twenty horse power.

You have stated that your Carriages do not do injury to roads, but are rather a benefit, subsequently you have said that your Carriages did not do half the injury of common Carriages?—Yes; if the tire of the wheel was very broad it would be no injury.

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Do you know the ordinary breadth of the tire of a Stage Coach wheel?—About two inches or two and a quarter, varying a little.

Do you know the weight of a Stage Coach, with its compliment of eighteen passengers?—Three tons.

What particular Coach do you refer to?—The Telegraph from London to Southampton, with its full load, has been reported to me, by its proprietors, to weigh about three tons.

What would be the weight of your machine when loaded?—Three tons besides its load.

What do you suppose the nineteen passengers weighed?—A ton and a half certainly.

The breadth of your tire is three inches?—Yes.

From your observation of the effect of a Coach weighing three tons, and a two and a quarter inch tire, going along a road, seeing the impression made upon the roads, and witnessing your own Carriage, weighing four tons and a half, with a three inch tire, what is the relative indentation or injury done to the road?—Not greater as far as I have ever been able to observe.

Is it as great?—I think not as great.

Independent entirely of the injury that the four horses do to the road?—Just so. Independent of that entirely.

Can you suggest any mode by which Tolls shall be fairly charged on Steam Carriages?—I should say by their weight, with a deduction in favour of the Steam Engines, inasmuch as they do not the same degree of injury to the road as a vehicle drawn by horses.

Do you think that the injury done by four horses on a road is greater than the injury done by the four wheels of the same Carriage?—Decidedly.

Upon what data do you state that opinion?—Because the animal must hold on as he goes, if he has a great weight behind him he must hold tighter than if he merely carries his own weight; I do not know the number of strokes that a horse's foot must have gone in an hour, but it is a great number, and where there are four horses those must be multiplied; and this on a road moistened by the rain must make great indentations and tear up the surface, the transit being continuous, the road must suffer more than from the mere pressure of the tire over it.

Do you state that as your opinion merely, or as the result of your observation and practice?—As the result of my observation and practice, and also from the deductions of reason.

Where have you made those observations?—In going about on horseback, in my own Steam vehicle, and my own Carriage, I have observed the manner in which the road has been cut up. I have also observed the road, after it has been passed over by a Steam vehicle, and have seen that part of the road we found injured by the horses' feet rolled over by the middle wheel.

In what state was the road at the time?—Rather wet.

Were the materials recently laid down, or consolidated?—There were patches of gravel; and there the Steam Carriage was a decided advantage.

Was it of more advantage than the wheel of an ordinary Carriage?—Yes, decidedly so.

Do you conceive that the injury done by horses' feet is in the wearing of materials, or the displacing materials?—In both.

What is the nature of the injury which the wheel does?—The wheel always forms for itself a hill, and that hill is in exact proportion to the indentation.

Do you mean to say that the hill is formed by the displacing materials?—Yes, there is a line, of the materials of which the road is composed, on both sides of the tire.

If a road is properly constructed, will that take place?—The harder the road the less the indentation.

Have you paid much attention to the construction of roads?—Not much.

Will you state more definitely the nature of the injury you have seen in regard to the effect of the horses' feet, in comparison to that of the wheels of Carriages?—First of all they displace at every blow, they tear up, and throw the surface behind them; whereas the wheel only rolls as it goes, and throws some portion on both sides of it, if the road is soft.

Do you know from your own knowledge how much the crust of an ordinary road round London will bear?—No; it depends so much upon the nature of the road.

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Mr. Alexander Gordon, called in; and Examined.

ARE you an Engineer?—I am.

Have you had much experience in the propelling Carriages, on common roads, by Steam?—My principal experience in that has been whilst observing what Mr. Gurney has done. I have also been connected with locomotive Engines, for which my father took out patents in 1822 and in 1824; and also with an Engine that Mr. Brown attempted to propel by a gas vacuum Engine in 1824, 1825 and 1826. I have not had time to prepare a drawing, but I have made a small sketch of two distinct patents (*producing the same*) which my father had in 1822 and 1824. The one in 1822 was a machine, with a small high pressure Engine in a drum; as the drum advanced with a rolling motion, it moved, before it, a carriage body on two wheels, attached to the front of the large rolling drum. Subsequently, in 1824, my father discontinued his former plan, and took out another patent, in which his object was to substitute propellers instead of the driving wheel; for that purpose he had propelling legs in the middle of the locomotive Engine, similar to horses' legs and feet, working through the bottom of the body of the Carriage against the ground, thus propelling the Carriage onward. Mr. Gurney's progress in 1826 and 1827 showed clearly that this arrangement was not necessary in every case, but that one of the wheels of the Carriage, when attached to the Steam Engine, had a sufficient hold of the ground to give progressing motion to the Carriage without using propellers; and the introduction of that invention has subsequently been given up by me in consequence.

Have both the plans you have given in been given up?—Both. They were given up from prudential motives on my own part, as it was an expensive business to proceed with them. Mr. Gurney had made such great advances that it would have been throwing away money I think to have gone on further with them. I found that the propelling feet, shown in the middle of the Engine, do more injury to the roads than the propelling wheels.

Have you been engaged in running Stage Coaches?—I was engaged in running a Stage Coach with horses four years ago, and since this Committee commenced their examination, I have been making some calculations as to the comparative wear and tear of the road by horses' feet and coach wheels; and I consider that the tear and wear of the horses' shoes is very much greater than that of the tires of the wheels. I know it to be so. A set of tires will run 3,000 miles in good weather, or on the average 2,700 miles, while a set of horses' shoes will travel only 200 miles. Take the square inches of the rubbing surface: I think the rubbing surface of the wheel, on an ordinary road, to be somewhere about sixteen square inches; I am taking a gravelly road.

Do you mean to say that if a coach was standing still, there would be a segment of the wheel of eight inches touching the ground?—On a gravelly road, with a dished wheel, it is about that; and I take the average of sixteen square inches, because all tires are not limited to two inches width: some of them are a little more; I take sixteen inches as the standard on the average quality of roads.

You state that eight inches of the wheel are imbedded in the road, in ordinary cases?—That is the fact. I took the whole together at the average. With the front wheels it would not be so much, on all occasions, as on the hind wheels. I take the average, allowing for this variation.

Do you give this answer from actual experiments?—From observation.

Having measured that part of the wheel which touches the road?—I cannot say that I have put my rule to it; but I mean to say a segment of eight inches is pretty accurate. If it is on a perfectly hard road, in dry weather the road will almost be a mere tangent to the circle; but on a soft road, in damp weather, the wheel will make more or less of a rut, and the average depth of the rut will give the average for the segment.

Will you give the proportion of surface for the horses' feet?—I think twelve square inches superficial for one horse-shoe. I cannot say that I have measured it.

What is the weight of the Carriage which you say imbeds itself eight inches?—I take the weight of the ordinary Post Coaches, when fully loaded, to be somewhere about three tons. I principally rest my opinion, as to the comparative tear and wear, upon the wear of the horses' shoes when compared with the wear of the tires. A horse, after a run of 200 miles must be shod; and after a run of 3,000 miles, in dry weather, a coach must have new tires.

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From thence you infer, that the wear of the two is in proportion to those numbers?—I think it must be thereabout; that is, setting aside altogether for the present, the consideration, that the horse's movement is a series of thumps and picks, while the wheel is a roller.

Is not the iron of the wheel thicker than that of the horse's shoe?—Yes; to keep the wheel firm.

Do you not infer, from the action of the horse's hoof upon the road, that the injury would be great in proportion?—I think that the action of the horse's foot on the ground is more destructive to the road: there is more tear and wear to the road by the horse's shoe than by the tire. In rolling two tons along the ground, on four wheels, there will be less damage done than by driving four horses without drawing any thing after them along the same ground.

Have you made any observations as to the relative wear of the shoes of riding horses compared with those of horses employed in Carriages?—No; I now speak from circumstances which came to my knowledge when I was connected with running a stage.

Have you had an opportunity of comparing the wear of the wheels of a Steam Carriage with the wear of the wheels of a Carriage, supposing they run equal distances and carry equal weight?—I have seen Mr. Gurney's proceedings from the beginning to the present time, and in riding with him, I have very narrowly observed the driving wheel to see whether it ever made a surd, (that is to say) made a slip or missed its hold of the ground, and that has so seldom happened, that I do not think it can do much more injury than any other wheel, indeed I might say none; if it does it is very trifling.

Sic in orig.

You speak of the propelling wheel?—Yes.

Do you know the weight of Mr. Gurney's Carriage?—I know the weight of Mr. Gurney's Carriage from having been told. I take the weight of Mr. Gurney's present locomotive Engine when it carries six or eight persons, to be nearly as heavy as an ordinary four-horse Carriage without the weight of its horses, that is about three tons with coke, water and passengers.

Are you speaking of the comparative injury to the roads done by Mr. Gurney's Carriage and a four-horse Coach?—Yes.

Which do you think does most injury to the road?—I should think it must be the same thing, carrying a great weight on any four wheels of equal diameters and surfaces; it will amount to the same thing.

Does not that suppose that the tire is of the same width?—I take the tires to be the same.

That is independent of the four horses?—Yes.

Then the injury done by the four horses is in addition?—Yes.

Have you observed what the proportion is of the damage done by four horses drawing a Coach and the four wheels of a Coach?—I cannot say that I have made any observation upon that further than the tear and wear of the shoes, and the tire. I have seen the ruts in a narrow road and the horses' path between them; viewing these and viewing the towing path on the side of a Canal and between the rails of Railroad, I should think that the horses do fully more harm than the wheels.

Do you think that the action of the horses' feet on a towing-path will do more injury than on a road?—Yes; but the action of a horse's feet on a towing-path is not quite the same as when he is carrying a weight or pulling a weight directly after him. The horse hauling on a canal has a motion sideways, and leans to the side farthest from the boat, platting his feet; this is a more destructive action than that of horses' feet on a road.

Have you found that there is any tendency to slip in Mr. Gurney's Carriages in going up a hill covered with new stones?—When the surface of the road is not firm, there is a tendency to slip; and when I said there was merely a fraction more of injury done by that wheel than by the others, I was taking such cases into account.

Do you think that the injury that Steam Carriages do to the roads will be exactly in proportion to their different weights, taking the same breadth of the tire?—I cannot state the proportion; if you increase the weight, you must increase the breadth of the tire; at different speeds the injury will differ.

Taking the same breadth of tires, and the same velocity, do you conceive the injury to the road increases in exact proportion to the weight; for instance, that a Steam Carriage of two tons will do only half the injury that a Coach of four tons

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would do?—I do not know that it will be exactly in these proportions, but it will be somewhat similar.

Then supposing that a Steam Coach carrying two tons, had tires of a breadth of three inches, and that a Steam Coach carrying four tons, had the tires of the wheels of the breadth of six inches; do you think that the injury would be proportionate?—I think that there would be nearly the same amount of injury.

Suppose you increase the weight so as to break through the crust of the road?—If you put a very heavy weight, you will break the crust of the road altogether, no doubt.

Do you think that could be obviated by increasing the breadth of the tire of the wheel?—To a certain extent; but you may increase the weight so much as to pulverize the material of the road, even with a broad tire.

Have the observations you have made been founded on actual experiment or not?—It is on observation; I have observed the action of Mr. Gurney's wheels very narrowly on the roads, because I was interested in another patent that was to introduce propellers in the middle of the locomotive Engine, as shown in the drawing produced.

Have you observed them under different ascertained weights?—No great variety.

Upon an ordinary road is the injury done by a Stage Coach or by a Steam Carriage so great as to be apparent at each time that Carriage travels along the road?—Whenever you see a mark left by a wheel you are entitled to say there is an injury done to the road to the extent of the rut.

Do you state that if it is merely a mark on the soft surface of the road?—Yes; from the wheel being at all imbedded in the soil; the water gets in and soaks its way through. If it is in frosty weather, the water and the damp get down, and the alternate freezing and melting destroys the road.

In an ordinary road is the impression of the wheel of a Stage Coach upon the solid surface of the road so great as to make the injury apparent every time the Carriage passes over it?—It is apparent to me, because wherever there is a mark upon the road there is a consequent injury.

Whether that mark is merely the impression of the wheel on the soft mud or dust, or by crushing the materials?—Wherever the road is damp the consequence of the mark, however slight, tends to destroy the road.

Do you mean whether on the soft mud on the road, or on the solid substance?—The road must be destroyed to some extent; I do not say that it is perceptible. If you put out of consideration the surface, the mere mud, it is not perhaps perceptible at the time, but there must be tear and wear going on on the road, or it will last for ever. I do not now talk of the action of the elements.

On what data do you state that the Steam Carriage does not do more injury than the wheels of a Stage Coach?—Because it does not make a deeper rut.

Does either of them make a rut?—If you suppose the road to be a concrete mass, and that there is merely a little mud and dust on the top of it I cannot prove that a four horse Coach does any perceptible injury to that road. I will say also a Steam Carriage will, in a similar case, do no perceptible injury to it.

Of course if the road was composed of solid rock you would not be able to tell whether a Coach of any description had gone over, there being no mark left, but talking of ordinary turnpike roads, should you be able to trace the indentation that Coach made?—Yes.

Would you not be able to do the same with a Steam Carriage?—Yes; there are some roads in England, a part of the Holyhead road, for instance, so well made that you cannot trace any vestige of injury done in good weather. A part of Mr. Telford's road there is a concrete mass.

Do you know whether that road has ever been mended since it was first made?—I suppose it has.

Should you not say that the injury done to the road by a Carriage passing over it, depends greatly on the state of that road whether damp or dry, or otherwise?—Certainly.

Are there any states in which a road is placed in which no injury is done by a Carriage passing over it, take the case of a hard frost for instance?—No perceptible injury is done in that case. If the road is so hard that the wheel makes no mark upon it. But where the road is at all soft, and when the wheel sinks into that road it must tend to destroy the road, if it be merely in mud on the surface of the road, it is making a cistern to hold a puddle of water.

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The greatest injury done to the road will be just after the breaking up of a frost?—Yes; or in fact after the effect of the frost, the water having got into the interstices, has been frozen and expanded. When it thaws the road is not so compact, it is soft and pulpy.

That is the state in which the greatest injury will be done to the road by a heavy weight passing over it?—Yes.

Have you ever, in such a particular state of the road, observed the injury done by a Stage Coach drawn by horses, and that by a Carriage propelled by Steam?—I have seen the locomotive Engine travelling in the month of January, and also the ordinary Carriages, and I cannot see that the locomotive Engine has done any more injury than an ordinary Carriage. The destruction on the road after a frost is much greater than in other cases.

Have you made observation as to the effect on the road by each Carriage when the road was in the worst state?—I have seen them exactly at the same time and in the same circumstances. In the month of October, when there had been a considerable deal of rain, and the old road to Barnet, down by Stanmore, was very soft in consequence of the rain, I have seen the effect of a locomotive Engine, and the effect of the Hemel Hempstead Coach running along side of each other, and I consider that there was no difference at that time; I was then watching the action of Mr. Gurney's wheels, and particularly his driving wheel, with that view. I put the horses out of the case.

Was there any perceptible difference in the damage done?—None, that I perceived.

What are the effects on the wear of the road, by increasing the velocity of the Steam Carriage?—I have not observed that, but it must be less. Suppose you are carrying a weight on a road slowly after a frost, you will break the crust; but travelling at a greater rate over it, it will not have that effect; the frozen crust will remain unbroken.

Have you observed the effect on the road, by increasing the diameter of the wheels?—I cannot say that I have seen that.

In Mr. Gurney's Carriage, the wheels do not always follow in the same track?—Sometimes they do, and sometimes they do not.

Under those circumstances, supposing equal weights on the four wheels, it would be easy for you to observe whether the wear of the fore and hind wheels was the same?—I never observed any perceptible difference in the injury.

A considerable proportion of the wear of the road is to be attributed to the atmosphere, without reference to the Carriages which pass over it?—Yes; the most destructive element in nature is water; and, in the course of the winter, the action of the water that gets sucked up into the road is very bad, and the very washing is also very bad.

Are there many states of the road in which a wide tire is of considerable advantage to the road?—Yes.

In the majority of cases do you think the superior width of the tire which the Steam Carriage has over a Carriage drawn by horses, is altogether an advantage or a disadvantage?—A wide tire has the advantage upon the average.

And the Steam Carriage has that advantage over the other?—Of late, Mr. Gurney has increased the width of his tire; it was at all times wider, but he has increased it still more.

Does the width of the tire impede the velocity at all?—Scarcely in a perceptible degree.

Are you of opinion that a wide tire, under any circumstances, does injury to a road in any state of it?—I have made no observation as to its doing an injury.

Complaints have been made that a great inconvenience arises to passengers along the road from the use of these Carriages, from the horses being frightened, in consequence of the peculiar noise, the smoke, and the letting off the steam; have you seen any inconvenience of that kind?—I have seen one case where a gig ran off for about 200 yards, and was then stopped without any accident. I have also seen the same thing happen with a Stage Coach; it is a common thing with a young shy horse. I have seen Mr. Gurney's Coach at work in the Barrack Yard, in the Regent's Park, and have not seen the horses frightened there.

Should you say you have seen a much greater number of cases of horses being frightened and running away attending the use of Steam Carriages than of common Coaches?—My experience in Steam Carriages is limited, and so must be that of every one when compared with the experience had with ordinary Coaches; I have

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seen Mr. Gurney's Engines, in going through the streets of London, and I have not seen horses frightened in any case; they may be shy, and prick their ears at it, but they have not started.

Have you turned your attention to the question, how Tolls should be fairly charged on such Carriages?—No.

Mr. Joseph Gibbs, called in; and Examined.

Mr.
Joseph Gibbs.

ARE you an Engineer?—I am.

Were you brought up to that business?—I was.

Are you the Patentee or Proprietor of a Steam Carriage?—I am Patentee of a new method of more economically and safely generating Steam, which I am applying to Steam Carriages.

Has it been practically carried into effect in Steam Carriages?—No; I am building Steam Carriages, one of which is complete. I have been to Cheltenham to see the effect of a Carriage there, and travelled nearly 100 miles between Cheltenham and Gloucester, with Mr. Gurney's Carriage with that view.

Did you find that any inconvenience arose to the persons travelling upon the roads from Mr. Gurney's Carriage?—I did not observe any particular inconvenience, certainly the horses shyed a little, that may be accounted for from too great a quantity of fuel being consumed, which caused too great a smoke and vapour, but that will be reduced as improvements take place.

Have you paid attention to the effect on the roads of Mr. Gurney's Steam Carriage?—I have.

Will you give the result of your observations?—I conceive that Steam Carriages do no injury to the roads further than the Carriages at present in use, no horses being applied, there is so much diminution of injury to the road from the horses not being used, the wheels I do not conceive do any more injury than those of a Stage Coach, supposing them of both the same weight.

Then deducting the weight of the horses, do you conceive that the injury is the same weight for weight?—Precisely.

What opportunity had you of examining the state of the roads after the Carriage had passed over?—I frequently went in a Carriage attached to the Steam Carriage, passing behind it, my object was to know the right width a wheel ought to be made to obtain sufficient traction, and I never saw any mud displaced which was upon the wheel during its revolution. I particularly remarked the indentations in the tire which will be made in consequence of the wheel coming in contact with the sharp flints upon the road, now if the wheel had slipped, the tire would have been grained or cut into small furrows, but that was not the case, I had the wheels cleaned in order to observe the effect.

Did you go up any hills?—The hill going into Gloucester.

At what elevation?—That I cannot say exactly; it is a considerable hill.

Do you conceive great improvements will take place in Mr. Gurney's Carriage?—I conceive great improvements will take place in all Steam Carriages; that they are in their infancy; that there are not yet sufficient practical data to form a perfect judgment by as to the ultimate shape of the vehicle, arrangement of parts, and weight of machinery.

Have you considered what would be the best mode of charging toll on such Carriages?—No, I have not yet paid attention particularly to that subject.

Is toll charged on Mr. Gurney's Carriage?—None was charged while I was there.

Have you seen Mr. Hancock's Carriage?—I have.

He carries his passengers, he does not draw them?—No, he does not.

Do you give the same result as to your experience of the injury from that Carriage?—Yes; except that Mr. Hancock's wheel is not cylindrical, it is rather conical, and a conical wheel must be more injurious to the roads than an upright one, although in this case, the wheel being narrow, the difference cannot be very great.

On the principle on which you state that you are forming your Carriages, shall you be enabled to diminish the weight greatly?—The Carriage I am now constructing weighs two tons without water, it is made stronger because there are not any practical data yet respecting the parts.

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Thomas Telford, Esquire, called in; and Examined.

YOU are aware that the object of this Committee is to ascertain, as far as practicable, how far the operation of Carriages propelled by Steam upon public roads is more or less injurious than the operation of Carriages drawn by horses?—I have never had any experience of Steam Carriages upon roads, and therefore I cannot say experimentally what effect they will produce, but if there is no projection upon the surface of the wheel and they are not suffered to drag upon the road, it does not appear to me that any injury can arise more, but rather less than by common Carriages.

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Do you consider that supposing the weight of a Steam Carriage were equal to that of a Carriage drawn by horses, that is two tons each, the injury done to the road by horses or by the Carriage would be the greatest?—I should expect that by the horses.

In a much greater degree, do you conceive?—I cannot exactly say the proportion, but I should think the greatest degree of injury arises from the horses' feet.

What is the nature of the injury done to roads by the travelling of Carriages and horses?—By the horses chiefly by tearing up the surface with their shoes; I do not consider that the pressure of the wheels upon a good made road is nearly so injurious to the road as the tearing up of the road by the horses' feet.

Supposing that the operation of a Steam Carriage were so perfect that there should be no sliding of the wheels, and that such Steam Carriage were of four tons weight, and also that the joint weight of a coach and horses were four tons travelling at equal velocity and with equal breadth of tire, which do you think would do the least injury to the road?—I should think that the Steam Carriage would do the least injury, but that is not from experience of Steam Carriages, but only from my general information, always taking for granted that there is no projection outside the wheel.

If under those circumstances, the breadth of the tire of the Carriages drawn by horses, were two inches and a half, the usual breadth, and the breadth of the tire of the Steam Coach were four inches, should you then have any doubt which would do the least injury to the road?—I have already said if the tires were equal I conceive the Steam Carriage would do the least injury, and certainly the chance of injury will be lessened if the tire is made double the breadth.

If the breadth of the tire of the wheels of Steam Carriages could be extended to six inches, might they not in many states of the roads be rather beneficial than injurious?—Where the road is properly made of good materials and well consolidated, the mere pressure of a Carriage would not have any effect.

Do you think it would be fair to impose an equal toll, weight for weight, on Steam Carriages and on Carriages drawn by horses?—I think it ought not to exceed that.

Do you think that it ought to be equal, as the one Carriage you state does not do so much injury as the other?—In justice it ought to be diminished, but that is only opinion until it is proved.

Have you paid any attention to the mode of charging toll on Steam Carriages?—I have not.

Mr. William Alltoft Summers, Engineer, called in; and Examined.

ARE you practically acquainted with the operation of Steam Carriages on common roads?—I am.

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Have you ever superintended the building of Steam Carriages?—I have superintended the building of two Steam Vehicles.

What was the weight of the lightest of those Steam Carriages?—The lightest of the two was about two tons ten cwt.

Do you give that from guess or from actual weighing of the vehicle?—From actual weighing of the vehicle.

That was without the charge of fuel and water?—Yes; without the charge of fuel and water.

What would that add?—The quantity of water we carried with that vehicle was five cwt., that carried us about eight miles, and the quantity of fuel we carried would be about four cwt. generally, that would last nearly double the time that the water did, we always carried an extra quantity of fuel to meet any exigencies on the road.

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On the mean of the distance that would bring it to about four hundred and a half?—Yes.

Then the Steam Carriage and the average charge of fuel and water, and the persons to guide it, would weigh about how much?—About three tons two cwt.

What is the greatest weight which you have known that Carriage to be able to carry exclusive of its own weight and charge?—I remember in one instance that we had ten persons upon it, and that we travelled with those ten persons at the average rate of about nine miles an hour.

On what road did this vehicle, you are speaking of, run?—It ran from Cable-street, Wellclose-square, to within two miles and a half of Basingstoke; (it was only an experimental journey, the same vehicle had run in various directions, about the streets and outskirts of London before;) that was the furthest distance we ran with it.

Is it running at the present time?—No.

Why was it given up?—When we arrived within about two miles and a half of Basingstoke, the crank shaft broke, and we were obliged to put it into a barge, and send it back to London.

Is this a Carriage of which the Committee have had any information?—No; the Committee have had no previous information respecting this Carriage.

Is this on the same principle as that described by Mr. Ogle?—No; it is not on the same principle.

Have you a drawing of this Carriage?—I have not; but I can explain the principle pretty clearly.

Have you abandoned the principle upon which this Carriage was formed?—Entirely; except that the boiler, with which it was furnished when we ran down to Basingstoke, was the same with which we travelled in the vehicle, of which Mr. Ogle has given a description.

When you were travelling with those ten persons, did you try to increase the speed?—Yes.

You were not able to do it?—We were not; because the size of our Engines would not consume the quantity of Steam generated by the boiler, and we were not able to go any faster, the Engines not being calculated for taking a sufficient quantity of Steam to produce greater speed.

What was the size of the cylinder with which you worked?—We had three cylinders, each four inches diameter, and the stroke of the piston twelve inches in each.

In the present Carriages which you run on the Southampton road, what is the size of the cylinders?—Seven inches and a half diameter each, and the stroke of each piston eighteen inches.

Do you apply your power immediately from the piston to the crank?—Through the medium of a connecting rod only.

You have witnessed the operation of Mr. Ogle's Carriage on the Southampton road?—I have always been with it.

He has stated that the weight of that is about three tons?—It is about three tons.

What is the greatest weight by actual experiments, exclusive of its own weight, that you have seen that Carriage draw?—We never weighed the present Carriage; but I remember nineteen persons being at one time on the vehicle.

To what distance did you carry the whole of those nineteen persons?—We carried those nineteen persons a distance of about three miles and a half.

Was that on a level road, or on a road with hills?—We ascended two very considerable hills in the distance; it was in the New Forest.

At what average speed did you travel with those nineteen persons?—We travelled at the average speed of nearly ten miles an hour.

What was the utmost speed with which you travelled?—We ascended one of the hills at the rate of more than fifteen miles an hour.

What do you suppose to be the inclination of that hill, and what the length?—I should think the inclination of that hill would not be less than one in twelve, and the length of it from half to three quarters of a mile; it is one of the steepest hills in the New Forest.

If you are able to drive up one of the steepest hills at the rate of fifteen miles, how is it that you give your average speed at less than ten?—The reason we travelled with greater speed up the hill is, that the fire was in better order on ascending the hill than whilst travelling on the level road, and caused a greater generation of Steam.

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You have stated that you went up at the rate of fifteen miles an hour, how did you make that calculation?—By counting the number of revolutions made by the hind wheels.

Are you quite sure there was no loss from slipping during that period?—I am quite sure there was no loss.

Having ascended the most difficult part at the rate of fifteen miles per hour, and placing your mean power at so low as ten miles per hour, and stating the reason of the mean being so low that the fire was in better order at one period than another; does it proceed from any defect in your fire place which renders it difficult to keep the fire always at a certain power?—At that time we had not the means of stoking or putting fuel on the fire through the centre of the boiler, the consequence of which was, that we were obliged to put a greater quantity of fuel on the fire than we otherwise should have been, which caused the fire to be a considerable time before it burnt through the fresh fuel; but having lately made a trifling improvement in our boiler, we now average with the present vehicle fifteen miles per hour.

Were you travelling for hire on that road?—We have never travelled for hire yet, but merely on experimental journeys.

You have never made the experiment of weighing your Carriage to ascertain at what rate you can travel with any particular weight?—We never made the experiment except by carrying persons.

Do you find it easy to increase the velocity with any certain weight?—That depends on a great many circumstances; the state of the roads has very great influence on that; but our power is capable of being increased to almost any extent.

As an engineer, what should you say would be the greatest weight which can be carried by a Carriage weighing three tons at the rate of ten miles an hour?—I have no doubt it would be able to carry three tons at the rate of ten miles an hour besides itself; and after the improvements I have in view are completed, I have no doubt that much greater weights may be carried at that rate.

Have you ever tried it?—We have never tried it; but I ground my opinion on having seen the Steam blowing off at both safety-valves, with tremendous violence, during the time we were travelling at the rate of upwards of thirty miles an hour.

What distance have you ever continued travelling at the rate of thirty miles an hour?—We have continued travelling at the rate of thirty miles an hour, four hours and a half very frequently, and could have continued to have gone longer had we not required a fresh supply of water, our tank being not quite large enough.

How could you continue to travel at the rate of thirty miles an hour, when you have already given so low a mean of the average of travelling on account of your fire-place?—Because it depends entirely on the quality of the fire; we have never found any difficulty in travelling over the worst and most hilly roads since our last improvement in the furnace, when the fire is in good order.

Have you watched the operation of your propelling wheels on the roads?—Continually.

Have you ever seen the operation of a drag on a common coach going down hill?—Very frequently.

What is the effect produced on a road which is nearly dry?—The effect produced on a very hard road when nearly dry is very trifling, but on a soft or gravelly road it does great injury.

Does not it produce a glossy appearance on the rut?—Always.

Is that same effect produced by your Carriage in going down a hill?—No, certainly not, because our wheels in going down hill are always revolving.

By what operation do you decrease the velocity of the Carriage going down the hill so as to check the inclination of itself to run down the hill, and yet keep it under control?—On arriving at the brow of the hill we throttle or wiredraw the Steam in order to check the velocity of the Engines, and if we find that the hill is so steep that the Carriage would run faster than we wish, we have two drags attached to the hind wheels, and with the foot we press on one drag or on both, as it may be required, and by that means regulate the velocity of the Carriage.

Does not that stop the motion of the wheel?—No, it does not prevent the wheel revolving.

How is the drag applied?—It is a kind of iron band or strap which goes round a portion of the tire of the wheel, and our power of breaking is multiplied by levers to a very great extent.

You have stated that the utmost weight your Carriage would carry, at the rate of

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ten miles an hour, was three tons; do you think you would be able to carry a much greater weight at the rate of five miles an hour only?—Certainly we should.

To what extent should you increase your power of carrying?—I cannot answer that from experience.

At what period of slow motion do you think that the increased expense of fuel would be greater than the use of horses in draft?—I have not ascertained that from experiment; but I think Steam will supersede horses in drawing Carriages, even at low velocities.

How often do you find it necessary to clean your boiler?—We have never found it necessary to clean it yet, it has been in operation more than twelve months.

Do you conceive that is owing to the peculiar quality of the water, or that under any circumstances that would happen?—We have had water of every description.

Is there no incrustation upon it?—Not the slightest.

Supposing there were incrustation upon it, would it be difficult to clean it, and would that require an engineer?—It would merely require a common labourer to clean the boiler, which might be done by removing some plugs that communicate with each of the cylinders of which the boiler is composed, and when required may be done with a scraper or wire brush.

What becomes of the carbonate of lime and the sulphate of lime, and so on, which are in solution in different waters?—Every time after we have arrived at our journey's end, we open a cock communicating with the bottom of the boiler; perhaps we do not give the matter time enough to rest, it is all blown out at the pressure of 240 lbs. on the square inch.

Have you ever had your boilers rent?—No, we have never had an instance in which the boiler has given way in any part of it, and in several instances we have had it red hot.

Of what material is it formed?—Of the best charcoal iron.

Have you ever tried it by pressure?—I proved the boiler before it was put into the Steam Carriage at 364 lbs. on the square inch; it will support 740 lbs. on the square inch.

At what pressure do you work?—We usually work it on the road at a pressure between 240 and 260, finding that pressure more economical than any other.

What surface of iron is exposed to the fire and heated air?—Two hundred and forty-five superficial feet; the weight of the boiler is eight cwt. two quarters.

What is the thickness of the iron?—About one-tenth of an inch; thin boilers last longer in proportion than thick ones, because the heat sooner passes through into the water, and has not time to act upon the iron.

For what period do you conceive that it is calculated to last?—From having had twelve months' experience, I should say it would last very well two years and a half.

During what portion of the twelvemonth was the Engine in actual operation?—It has not been in constant operation every day; but we have been in the habit of going out four days out of six, and working from eight in the morning till seven or eight o'clock at night; the boiler is not at all injured, it is in the same state in which it was when first put into the vehicle; neither have we had any accident with the machinery, contrary to the opinion of almost every engineer who saw the vehicle before it left London; the vibration or jar being much less on common roads than on a railway, and the whole of our machinery being suspended on springs; the Engines work as smoothly as if they were fixed on the firmest foundation.

Where are the passengers placed, in reference to the boiler?—They are placed in front and in the middle of the vehicle, and the boiler is entirely behind the body of the Carriage and the passengers.

You are frequently in the habit of passing horses?—Yes.

Do you find that they are frightened?—I have occasionally observed them shy, as they sometimes do at a wheelbarrow; but we never had any accident from horses being alarmed.

Do you find it less now than at the commencement of your experiments?—Certainly.

Is there a peculiar noise attends the motion of your Engine?—The noise is not so great as in a vehicle drawn by horses.

Is there any peculiar noise from the escape of your steam?—I cannot say that there

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there is no noise at all ; there is a noise, but it is so trifling that the rattling of the wheels on the road entirely drown it.

Is there continually steam being let off from the safety-valves?—Almost continually.

Does that produce any disagreeable effect to the passengers?—None whatever ; all the waste steam is blown into the furnace, which entirely prevents any noise that can be heard on the road.

It has been stated to the Committee, that in some Steam Carriages actually in operation, there is a very peculiar noise from the escape of the steam, from whence does that proceed?—It proceeds in one Carriage, which I have seen running along the roads, from the steam being blown in at the bottom part of the chimney of the furnace, at a distance very near to the open air.

That may be obviated by a different form of chimney, may it not?—No doubt it may.

You are aware that that principle is one of the most important principles which has been introduced into the working by steam?—I am quite aware, that on the Liverpool and Manchester Railway that is the principle they have adopted with some success. We have produced the same effect by another, and I think better means.

Will you state by what means you produce that effect?—Instead of blowing our waste steam into the chimney, in order to produce a draught, we have a fan or blowing machine, which is driven by the Engines when in operation, and this gives us intensity of heat in the furnace. The waste steam from our Engines goes into a double casing round the furnace ; we admit a small portion underneath the fire-bars of the grate, and the remainder is allowed to expand itself into the double casing, after which it comes over the top of the fire, and escapes in the form of invisible vapour.

Then in fact you arrive at the same result, but with this difference, that you increase the draught of the fire by using a certain quantity of the power of your engine, whilst those who introduce the steam into the chimney increase the draught by a power which you throw away?—We have tried it in both ways, but we find this the most advantageous, because in those Carriages in which the steam is driven into the chimney to produce a draught, the aperture is so much diminished in order to produce velocity of current and corresponding increase of draught, that the waste steam is choaked in escaping from the engines, and produces a greater loss of power than by working the fan.

From your experience in Steam Carriages, do you conceive that it will be necessary to make any alteration of the present roads, such as paving them for the purpose of this mode of conveyance?—No, certainly not ; we have found that our vehicles will travel over every kind of road with great velocity, and up the steepest hills ; from observation which I have made very minutely on the operations of the vehicle, my decided opinion is, that if the common roads were put into a tolerably good state of repair, we should be able to carry all the goods which a railway would be able to carry, and at much less expense, taking into consideration the original expense of the railway and its continued wear and tear ; I believe I have from a correct source of information, that every yard of railway loses on an average about four ounces per year in weight when it is in full operation ; this loss arises from oxydation, and the action of the great numbers of wheels of the Carriages that pass over it.

Have you travelled over pavements?—Very frequently.

Did you find that your Carriage travelled with greater ease over them?—With much greater ease.

Supposing you had a pavement to run on, what increase of power should you gain by running on that rather than on a common Macadamized road?—We find that when we are travelling on a rough bad pavement we do not consume more than one-fourth of the steam we do on a gravelly soft road.

You conceive you increase your power $\frac{3}{4}$ on a paved road?—Yes.

What steepness of hill have you ever ascended?—One foot in six ; I measured it myself ; that is the hill at Shirley.

Were there any symptoms of the wheel slipping in that case?—Not the slightest ; we had both the wheels in gear at the time we ascended it.

At what velocity did you ascend it?—At a velocity of nearly five miles an hour.

What weight had you?—We had fourteen or fifteen persons on the Carriage.

Did you find any difficulty in working?—Our Engines worked with perfect freedom.

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What distance did you travel on that ascent?—The hill is about 200 yards long. You are now improving the form of the Carriage, are you not?—Our present operations are in improving the form of our vehicle, and the arrangement of the different parts of the machinery.

For what number of passengers will your present Carriage be calculated?—Eight inside and sixteen outside passengers.

How many wheels have you?—Our present vehicle is on three wheels, our proposed Carriages will be on four wheels.

In what space can you turn on a road?—We have frequently turned entirely round on the London road leading from Southampton, in the space in which a post chaise can turn, or rather less.

Supposing you were travelling at the rate of ten miles an hour on a level road, in what number of feet do you suppose you should be able to stop your Carriage entirely?—We should be able to stop the vehicle in the space of twelve feet; I have ascertained this from experiment, when we were descending Staines Bridge, which is very steep, one of the crowd fell down in front of the vehicle, very near the vehicle, we immediately reversed the action of the Engines, and the man escaped without any injury.

When you state that you can stop in twelve feet, is that by reversing the action of the Engines?—No; by merely shutting off the communication between the boiler and the Engines.

But supposing you were in such situation that it would be requisite to stop in a much shorter distance, could you do it instantaneously by reversing the Engine?—We could certainly stop in the space of three feet by reversing the Engines; but it would not be prudent to do so in less as it might endanger the lives of the persons on the vehicle by their being pitched or thrown forward.

Have you turned your attention to the question by what mode Tolls would be most fairly charged on such Carriages?—I have not turned my attention much to that subject.

What is the horse power of your Engine, according to the common modes of calculation by engineers?—About twenty horse power.

On the Liverpool and Prescott road the toll for Steam Carriages is as follows: for every Carriage not drawn by horses, but propelled or moved by machinery, any sum not exceeding the sum of 1*s.* 6*d.* for each horse power; would you be able to run your coach subject to a toll so high as that?—We certainly should not be able to run it to any advantage.

What advantage in point of expense do you anticipate to the public from the use of steam in propelling Carriages over that by horses?—I have no doubt that when they arrive at tolerably practical state of perfection, passengers will be carried the same distance which they are carried now by horses at the same velocity for one half of the expense, it may be even at less than that in future.

What mode should you suggest as the fairest for placing tolls on those Carriages, by passengers, by the wheels, by the horse power, or by the weight?—I should certainly suggest that the tolls should be levied by the number of passengers the vehicle carries, provided the breadth of the tires of the wheels be increased in proportion; as to vehicles for carrying merchandize, I think the tolls should be in proportion to the weight which such vehicles are capable of carrying, the velocity of the vehicle travelling on the roads not materially affecting the state of them.

Many Turnpike Acts having passed this Session, which place tolls on Steam Carriages, how would Parliament be able to adopt one principle of placing toll on the passengers?—The proprietors of Steam Vehicles will always carry as many passengers as they can, and the greatest number of passengers that they are able to carry should be the standard at which the tolls should be levied.

Supposing that on two roads the toll on a coach calculated to carry eighteen persons, was 2*s.* and on the other 3*s.* how would you propose that any scale should be adopted by which a toll could be introduced applicable to both those roads?—My opinion is that the toll on Steam Carriages ought not to exceed one half of the toll paid by other vehicles drawn by horses, because they do not injure the roads more than in that proportion, probably not so much, the tires of the wheel having been increased in proportion.

Your new Carriage will be calculated for twenty-four persons, the average of Coaches carry eighteen at their utmost, how would you proportion the tolls on your Carriage and on Carriages drawn by horses?—My opinion is, that it would be but justice

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justice that the Steam Vehicle in such case should not pay even more than one-half that which is paid by other vehicles carrying the same number of passengers; therefore supposing the average of Coaches carried sixteen passengers and that the toll charged upon them was 2s., the toll paid by the Steam Vehicle, carrying twenty-four passengers, should be 1s. 4d.

What do you think ought to be the breadth of the tire of a Steam Carriage calculated to convey sixteen passengers?—Three inches.

What do you think should be the breadth of the tire of a Carriage calculated to convey twenty-four passengers?—Not less than four inches, probably it may be found advantageous to make the tire wider than that in practice; I think it probably will.

Do you think that Steam Carriages should be licensed to carry a certain number according to their power?—I think they should.

What do you mean by their power?—It will be to the advantage of every Steam Coach proprietor to carry as many passengers as he can, giving each passenger sufficient accommodation, and he should have a license for that number and no more; each of the passengers should have the same quantity of space allowed them as they have in the present vehicles drawn by horses; it is my opinion it should be the comfort of the passengers which should be consulted.

Should you have no reference in the license to the power of the Engine?—I think not; because the danger does not increase, as the power of the Engine increases.

How would you suggest that an equivalent duty should be placed on Steam Carriages, so as not to give them an unfair advantage over common coaches?—I am not able to give any opinion upon that subject.

Can you give any reason why the same amount of duty should not be charged on Steam Carriages as is charged upon the present Stage Coaches?—I cannot give any reason, except that I think it would be extremely improper to place such duties on Steam Vehicles, in their present infant state, as to crush so important an invention.

Mr. Joseph Gibbs, again called in; and Examined.

HAVE you any observations to make, in addition to your Evidence given last Wednesday?—With a view of giving my opinion upon the best method of collecting tolls from Steam Carriages, I will commence by stating, that Steam Carriages can be constructed upon three several principles; my object being to show this Honourable Committee the difficulty in collecting tolls from Steam Carriages, except by the number of wheels, without stopping the progress of that improvement in which they stand so much in need. Steam Carriages can be constructed as follows: first, Steam Carriages which propel themselves, and carry the supply of water and fuel, likewise passengers and goods; second, Steam Carriages which propel themselves, and carry the supply of water and fuel, but draw the load after them in a separate Carriage or Carriages; third, Steam Carriages which propel themselves, and partly carry passengers, goods, fuel and water, and draw the rest in a separate Carriage or Carriages after them. This will show the great difficulty of levying a toll upon the weight of Steam Carriages; as for instance, 600lbs. of water and 100lbs. of coke are requisite per hour on an even road, with a Steam Carriage as now constructed; but upon a road, abounding with hills, 1,000 lbs. of water and 160 lbs. of coke will be required. Now if the weight is taken when the water and fuel are one-half diminished, say on the average 400 lbs. of water and 65 lbs. of coke, and the toll is levied upon the weight of the Steam Carriage, the Carriages (being drawn) paying as ordinary Carriages, the weight of water and coke can be transmitted to those Carriages which paying, not by weight but by the number of wheels, will of course receive an augmentation of from five to six hundred pounds additional weight. Likewise the danger from explosion will be increased if tolls are collected upon the weight of Steam Carriages, inasmuch as by loading the safety valve to double the pressure, a Carriage can be made to draw double the weight with only an alteration in the fire place, and an increase of water, air and fuel; a diminution of weight will likewise take place to a considerable amount in the boilers and engines, although it is more essential an increase of strength should take place rather than any diminution. I can state a case in point; I have a Steam Carriage now constructed, from which I could abstract 900 lbs. of iron without making it too weak to travel even on rough roads, but I should not be induced to do so except as a matter of economy in case

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the tolls are levied upon the weight and at too high a rate. The Steam Carriage as used upon common roads, being an invention of recent date, sufficient has not been done with them for practical men to decide what arrangements of machinery are best for their construction. It may be found hereafter that it is proper to place the Engine in one Carriage and the boiler on another, and blowing apparatus in another, all carrying other weights, so that three distinct Carriages (although they each carry only a part of a Steam Engine with them,) yet if so arranged, and tolls are collected by the weight of the Steam Engine, the whole of these Carriages would be liable to pay toll by weight. I think that in carrying heavy goods it is more than probable the Steam Engine will be on a separate Carriage, and the power transmitted to the hind axle of the Carriage containing the goods, by means of a flexible bolt or intermediate wheels, in order to obtain a slow motion of the Carriage, the speed of the Engines being the same; but does not this connect them, so that they may be considered as one Carriage, and liable to pay by weight? As it is probable that Steam Carriages or locomotive Engines will be used for ploughing, or to draw the plough to it, the Engine remaining during that time in its location, and only moving when the plough has completed its furrow, yet, in going and returning to the field, it may travel upon a turnpike road, and be subject to the toll of a Steam Carriage; an Engine of this description will be very heavy, and unless a provision is made, the farmer would be obliged to attach horses to it to prevent its being considered a locomotive Engine. It appears to me that the only method of collecting tolls is by payment (under proper regulation) on the number of wheels employed, and not on the weight of any part of the train, for if one part pays by weight and the other upon the number of wheels, the weight can be removed to a dangerous extent from the part paying by weight, and placed to an injurious extent upon the part paying by the number of wheels. I can well appreciate the difficulty the Committee must have to contend with in coming to a just decision as to the best method of levying tolls. I have been a number of years constantly having new inventions under my consideration, as well as being the inventor of several patent inventions which are now in full operation; therefore, without presumption, I feel myself qualified to give an opinion. I have constantly observed that all new invented machines entirely change shape, dimensions, weight and general arrangement of parts as they approximate to perfection, so that the perfect machine could not be recognized by persons unacquainted with the subject as being intended for the same purpose as the original machines, yet, during all these successive alterations, the principle of the machinery remained unchanged. I make these observations to show the difficulty of anticipating the ultimate power and dimensions of locomotive Carriages.

Will you exemplify your proposition as to the payment of tolls, giving 2 s. as the amount of the tolls for a Carriage drawn by horses; what amount of tolls should be charged on the two following Steam Carriages, the one Carriage to carry passengers on itself, and to weigh four tons; and supposing in the second, the engine part of the Carriage to be separate, the Engine Carriage and the Carriage drawn weighing together four tons, should a higher amount of toll be chargeable on the one Steam Carriage than the other?—I think not.

Yet the one has four wheels and the other has eight wheels?—My opinion is, that it ought to pay the same tolls it does now, supposing they are of equal weight, the diminution of the horses being taken into account.

Then your proposition would be resolvable into charging tolls by weight?—Of course; I contemplate that a regulation will take place, that only a certain weight shall be placed upon the wheels, and the width of the wheels will come under a regulation.

Then it becomes absolutely a toll on weight?—Not exactly so; I am only stating the limits I think they ought to carry.

In the case stated on the one Steam Carriage carrying the passengers with the Engine, and the second the Engine being placed in a separate Carriage from that containing the passengers, both Carriages being of equal weight, that of four tons; but in the one case there being eight wheels, and in the other only four, would you charge a different amount of toll on those two Carriages?—I would charge in proportion to the weight carried. In stating this I conceive that there should be a maximum weight which Steam Carriages ought not to exceed.

What should you suggest as the standard of weight?—I have not turned my attention to that part of the subject, but I will do so if it is wished.

Are

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Are you aware what the average weight carried in vans is?—I have made inquiry from van proprietors, and find that they frequently carry six tons, including the weight of the van, but the average weight is about four tons, and the width of their wheels is from $2\frac{1}{8}$ inches to $2\frac{1}{2}$ inches.

Do you anticipate that steam will be applied shortly for the purpose of conveying goods in vans?—I believe it will; I contemplate the putting some vans on the road to be worked by steam.

Will such Carriages be on four wheels or on any greater number?—I think it probable that they will be on a greater number than four wheels, from six to eight wheels.

What do you conceive to be the maximum weight that ought to be placed on a wheel of three inches width?—One ton and a half ought to be the utmost limit.

Mr.
Joseph Gibbs.

19 August,
1831.

Jovis, 25^o die Augusti, 1831.

Mr. James Stone, called in; and Examined.

WHAT are you?—An Engineer.

Have you had the superintendence of Sir Charles Dance's Steam Carriage?—Yes, I have.

On what road does it run, and how long has it ran on that road?—It was running regularly from the 21st of February to the 22d of June inclusive.

During that period has any accident occurred?—Yes, by the breaking of the axletree.

Mention the nature of the accident?—We supposed it broke, in consequence of an unusual quantity of stones laid down upon that part of the road that was always the most difficult to pass over; but no accident as to the bursting of the boiler, or any other thing took place, that occasioned any unpleasantness, or any thing like a serious accident as to injuring any persons. We had several little stoppages from defective tubes, of which the boiler is constructed; but nothing accrued from that, except merely stopping the progress of the Carriage.

Was the Carriage able to work with the axletree broken across?—It broke about a mile and a half from Cheltenham, and it came back all the way to Gloucester, notwithstanding the axletree being broken; one of the Engines was able to work during that time, and, of course, having only one Engine, when it came to a hill the men were obliged to assist it over the centre, as there was no momentum.

Can you state, accurately, the weight of the Carriage?—I cannot.

As far as you have observed, is the injury done to the roads by the passing of the Carriage, greater or less than that by a Carriage drawn by horses?—I think, taking the horses into the account, the injury must be much less; the tire of the wheels is three and a half inches wide, whereas many of the Stage Coaches are as heavy as the Steam Carriage, and with narrower wheels; and I think it is only fair to take the weight of the horses into the account, which I have found to be from eight to ten hundred weight each horse, consequently, four horses would weigh from a ton and a half to two tons.

You are answering now from theory; you were directed to answer from observation?—From observation, I do not think that the Steam Carriages injure the road so much from the wheels being wider.

How frequently do you clean the tubes of the boiler?—It would be necessary to clean them once a month; I should recommend that, but if they were actually cleaned once in three months they would not give way; it depends upon the quality of the water made use of.

Is there great facility in cleaning them?—Very great; it is merely removing opposite the end of the orifice of the tube the screw bolt; it is only to withdraw the screw-bolt and introduce the cleaning rod. We are in the habit of blowing out the tubes every two or three days, to cleanse them.

What is the greatest number of passengers you have taken on that Carriage?—Thirty-six.

Thirty-six passengers and their luggage?—Yes, but being a short stage, there is never much luggage.

What do you suppose is the greatest weight you could draw by that Carriage, at the rate of ten miles an hour?—From forty to fifty hundred weight; it is found to be drawn much easier by dividing the weight into two Carriages than taking it in one only.

Mr.
James Stone.

25 August,
1831.

Mr.
James Stone.

25 August,
1831.

Do you work, on an average, at half your utmost power of working with safety to the Engine?—I should think we did.

Full half?—Yes.

Do you think more than that?—It depends so much upon the state of the fire.

The question was, Do you work, on an average, at half your full power?—Yes, I should think we did. The greatest weight we ever drew on the common road, at a rate of from five to six miles an hour, was eleven tons.

Is that merely by guess, or did you actually weigh?—By weight; we made the experiment on the Bristol road.

What should you suppose to be the weight of the drawing Carriage?—The weight of that was upwards of two tons.

Then it drew five times its own weight?—Yes, it did; the eleven tons I have stated, included the weight of the drawing Carriage; and I did not consider that the maximum power at all.

Did you ever try it at a less velocity?—No, because, in applying the greatest power, we confine both the wheels to the Engine.

Did you draw the nine tons with only the power of one wheel?—Yes.

Are you able, from the two circumstances you have mentioned, to say, that at three miles an hour you could draw considerably more weight?—Yes, I have no doubt of it whatever.

On what breadth of tire was that weight drawn?—I think the tire was five inches of the propelling Carriage.

For what distance did you continue to draw that nine tons?—A mile and a quarter.

Did the road vary in its inclination?—Yes, a little; the greatest elevation could not be more than one in twenty-five.

Did you ascend an inclination of one in twenty-five with that weight?—Yes, we did.

For what distance?—From twenty to thirty yards.

And, on the average of the mile and a half, was it an ascending or a descending road?—It was both; there were little undulations in the road.

Can you measure accurately the power you are employing at any particular time; have you any gauge?—No, we have never applied one; I have conceived one, and am going to apply it.

A barometer tube?—Yes, that is the one. I think it right to state, that the wheels were taken off that measured five feet diameter, and others were substituted, measuring only three feet diameter.

Do you wish to have it inferred from that, that you employed in both cases the same amount of power?—There must have been a little more power with wheels of three feet diameter.

Do you think you exerted your utmost power when you were drawing nine tons?—No, and for the reasons stated, that there was only one wheel affixed to the Engine.

May you not exert your utmost power upon one wheel, taking into consideration that the strain is greater?—No, the wheel would slip round.

Was the surface of the road on which you tried that heavy weight broken up, or in any way rough, to give a greater amount of friction?—No, it was a good hard road.

What proportionate charge do you make for conveying passengers between Cheltenham and Gloucester?—One shilling.

What do the Coaches charge?—Half a crown the four-horse Coaches, and two-horse Coaches 2s.

Travelling at the same speed do you think you could charge in the same proportion?—Yes.

There would be a saving to the Public of more than one-half?—Yes.

Have you taken many passengers?—Yes, a great number; from February to June, between three and four thousand passengers. I have a book containing an account of the number of minutes that each journey took.

The Committee have received a letter from the Surveyor of the Gloucester and Cheltenham road, stating that there is a very great noise proceeding from this Carriage?—I have not heard that observation generally; there is a little noise, but not much.

With

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With red hot burning coals falling on the road continually, or whenever the fire was moved?—That has taken place when the ash pit has been burnt out, but that is not necessary; the Carriage I have recently fitted up will not be subject to that.

You are of course aware that the letting coals drop is desirable to be obviated?—Yes, and that I have guarded against.

He also states few animals will pass it without being frightened; and often the traveller was obliged to take his horses into the fields adjoining the road; and very many who did not use that precaution had been placed in the most perilous situations; and that a gentleman's Carriage, in the neighbourhood, was overturned from the horses taking fright at it?—Yes, I have understood that; but that Carriage has been overturned once or twice owing to the carelessness of the driver. I have seen the gentleman, and he did not think any thing of the accident, the Coach turned round, and the coachman jumped off, but I never saw any thing bordering upon an accident during the time I was with it.

He states, that persons have completely deserted that road?—I have never known but one individual that has been against it at Gloucester; but I have seen horses take fright at a Stage Coach and not at our Carriage. In one instance, going out of Gloucester, we were just behind the Stage Coach, and a horse in a chaise coming past took fright at the Stage Coach, and when he came up to us he took no notice of us, and therefore, I am fully persuaded, that horses do not take more fright at us than at a loaded Stage Coach, from the observations I have made upon a number of experiments.

Were there 14 inches of stone laid on the road at the time the accident happened of the breaking the axletree?—Yes, it was; when the stones were levelled they measured seven inches, but at that time they were merely laid across the road, so that the Carriage could not pass them without going through them.

Do you know that the passengers on the common Stage Coach got out and helped the Coach along?—No, I do not know it, I only heard it; I do not know it.

Mr. James M^cAdam, called in; and Examined.

ARE you Surveyor of the Holyhead line of road?—As far as St. Alban's.

Have you the superintendence of any other portion of it?—Of no other portion of it.

Have you had considerable experience in road-making, and superintending roads?—Yes, for the last fourteen years.

Have you made any experiments, or are you able to give any information to the Committee, as to the comparative wear of roads, or injury to roads by Carriages and horses passing?—I have generally found that horses' feet do very great injury to the surface of a well-made road; and I am of opinion, that a Carriage with properly-constructed wheels does less injury to a road than the horses drawing.

Would you explain what the operation of the injury done to the road is by travelling on it; is it the wear of the road, or the displacement of the materials?—Both take place; the wheels to a certain degree wear out the material, but upon a road properly constructed, and that has become consolidated, and the surface smooth, that wear is very small and gradual; the injury to the road from the horses feet, more especially upon gravel and flint roads, arises particularly in dry weather from the knocking up and displacing the materials upon the surface, and each succeeding journey adds to the evil, and were it not for the effect of the wheels following the horses in mitigation of that evil, we should have the flint and gravel roads all loose throughout the whole summer.

But the wheels of the Carriage do not actually follow in the track of the horses?—But in roads of much thoroughfare, especially near the Metropolis, other Carriages do.

On the Metropolis Roads have you made any new regulations as to the mode of charging tolls by weight or otherwise?—In the last Act passed for the Metropolis Roads, the toll was put upon the horse drawing, and a regulation as to the formation and breadth of the wheels expressly enacted, by which all wheels were required to be not convex, but a perfectly flat surface, with no projecting nails; but by the powers granted to the Commissioners in that Act, that perfectly flat surface was mitigated to a surface not exceeding a quarter of an inch from the flat surface, to meet the practical effect arising from the wear of the wheels upon the road; and to prevent litigation at the several gates, by applying a gauge, a toll of 3d. per horse

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for each seven miles is payable upon a six-inch wheel so constructed; a quarter more upon a wheel so constructed of four inches and a half in breadth, and a half more upon a wheel less than four inches and a half. Those additions do not apply to Stage Coaches or Carriages with springs. The toll upon all horses drawing Carriages and Coaches with springs is 3*d*. a horse for seven miles, whatever may be the breadth of the tire.

You have had no reference to the weight of the Carriage drawn in your rate of the tolls?—There is no reference to the weight drawn in any Waggon or such like Carriage, provided the wheel is of the construction required by the Act, and the result of some years' experience proves that no injury whatever is sustained upon a well-made road, from any weight practically carried in Waggons, or such like Carriages, with wheels as described.

You do not mean that the Committee should infer weight is of no consequence, but that the power of the horse will be your guard against an overweight being drawn?—Yes; the toll being laid per horse, I consider that the penalty in the shape of toll per horse, more than compensates for the injury done by the weight. Before those regulations took place, the roads in truth sustained an equal pressure, from the well known fact that the Weighing Engines were universally compounded for by all the carriers, and that the roads, after these regulations, had no greater but even less weights to sustain than before that took place, and it was observing that fact, which induced the Commissioners of the Metropolis Roads to do away with all the Weighing Engines.

Do you know whether the Holyhead Road Commissioners are trying to do away with the necessity of Weighing Engines?—Upon the Trusts, on that line of which I am Surveyor, the Trustees have done away with all the Weighing Engines, and the happy result of compelling the Waggons to set out and arrive upon the Metropolis Roads with properly constructed wheels, has had the effect of enabling the Trustees upon all the roads within a circle of fifty to eighty miles, to dispense with the Weighing Engines; also, because if the Waggons set out and arrive in the Metropolis District with a properly constructed wheel, it was not worth their while to alter it, but to travel throughout to Cambridge, Newmarket, &c. with the same wheel; and the benefit of the metropolis wheel has extended itself in consequence.

Then supposing a broad wheel waggon with dished wheels was to pass through your turnpike, what rate would be charged?—It would be charged the highest rate of a narrow wheeled Waggon.

Have you heard any complaints from the Waggon masters of the regulation of the form of the wheel?—On the contrary; a few days since we had a Petition most numerous signed by the Waggon masters from Norwich, Cambridge, Newmarket, &c., requesting the Trustees of the Wadesmill Road to dispense with the use of their Weighing Engine, they having found by experience that the wheels required by the Metropolis Commissioners, were not only best for the road but the most advantageous for themselves to use, and in consequence of that application, on Friday last, the only remaining Engine on the roads of which I am Surveyor, was ordered to be abandoned.

Can you state the weights of a loaded Stage Coach, and a loaded Waggon, and a loaded Van, on the average?—I should state a Stage Coach loaded, at from two and a half to three tons; a Waggon from five tons to seven and a half.

Does that include the weight of the Waggon?—Eight tons would; I should think the weight of the Vans about four or five tons.

Have you observed the operation of wheels when they are dragged?—Yes; they are injurious upon roads newly coated certainly, but upon an old road, I mean a road that has become consolidated upon the surface, the injury, with proper skid pans is but small, and confined of course to one side of the surface of the hill.

Do you think the efficacy of your toll in protecting the road is equally applicable to a heavy Van as a loaded Coach?—I think that the toll per horse will always be a sufficient guard for the weights drawn, the Van being on springs does infinitely less injury in proportion than such a weight without them.

But if the injury to the road proceeds from the weight the horses have to draw, the same rate of toll would not be applicable to a Carriage of two tons and one of six tons, both being drawn by four horses?—Certainly not; but that is a supposition hardly fair to be taken, because we conclude that the additional weight requires additional horses.

But in practice the Vans pass all through the country with only four horses, and the

the Coaches equally with four horses?—That is true; the Coaches go at a much more rapid pace.

Do you think that the velocity with which a Coach goes, has any thing to do with the wear of the road, or is it not actually less injurious in proportion to its velocity?—In some instances where any blow takes place the speed does more injury to the road by crushing the materials.

You did not contemplate the general use of Vans when that Act was drawn up?—No; not that they would come into such general use.

What proportion of the injury to the road do you think takes place from the changes of the atmosphere; frost and wet, has it any material effect?—Yes, decidedly, in chalk soils in particular; at Royston and through that country a great and serious injury takes place upon the breaking up of all frosts, nor can we, by any care or attention or strength of surface of the road prevent that taking place; it comes in a very eccentric manner and breaks up one year at one part of the road, and another at another, occasioned in a great measure by the standing of the water in the sub-soil; and I suppose also, by the way in which the wind is at the time it freezes. It is the modern practice of road making to abstain from all general repair of the roads from the middle of April until the middle of October; during that period the only repairs that ought to take place are partial coatings, necessary from accidental circumstances. As soon after the middle of October as possible the general coating takes place in pieces of the road at a time so as to interfere and interrupt as little as possible with general travelling, and we endeavour, by the month of February, to have the whole of the coatings put on; in no instance above a sixth part at a time.

On your line the Committee find, that the course of horizontal traction varies from 42 to 140, with these remarks, in the case of 42 “granite surface of many years standing,” and the 140 “smooth surface road made of broken granite;” can you explain why such a difference should take place, both being smooth surfaces?—I am quite unable to account for it; no coatings of dirt upon a granite road ought to have produced so great a difference.

Have you witnessed the operation of a Carriage propelled by Steam on the public roads?—I have observed it; but in a small degree.

Who was the proprietor of the Carriage you noticed?—I think it was Mr. Gurney's; I accidentally saw it.

Then you only saw it once?—Only once.

What was the state of the roads when you saw it?—Tolerably good at the time; I saw it in the Regent's Park.

Were they in such a state you could make any observation upon the greater or less injury produced by it than by a common Carriage?—I cannot say that my attention was directed at that time to that fact; I have not had an opportunity practically of seeing the effect of Steam Carriages upon roads; there have been none used near us except passing down to Virginia Water, &c.; but not being brought into general use, I have not seen sufficiently the effect of their wheels upon roads.

From the experiments you have before stated, what should you recommend should be the breadth of the tire of the wheel of a Carriage with four wheels weighing four tons?—I consider that a Carriage of any description required to carry a great weight, five or eight tons, ought to have a wheel of four inches and a half in breadth, constructed agreeably to the Clause in the Metropolis Act; and I consider that a Carriage with such a wheel, though carrying an excessive weight, would do very little injury to the road.

It has been stated by a previous Witness, that a Carriage of the weight of two tons propelled by Steam, drew after it another Carriage weighing nine tons; what should, from your experience, be the breadth of the tire of the wheel of the propelling Carriage and the Carriage drawn?—Looking solely to the welfare of the road, I should prefer a wheel of four inches and a half, flat on the tire, to any other class of wheel that can be made, being of opinion that a greater breadth of wheel cannot at one time touch the surface of a well-formed turnpike road.

Then you would prescribe that breadth as the minimum breadth of wheel for any weight?—Yes; I do not think any increase of breadth would be of any service.

Supposing two Carriages, one drawn by horses, and the other propelled by Steam, the weight of the Steam Carriage being four tons, and the weight of the Carriage drawn by horses being two tons, which would do most injury to the road,

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Mr.
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provided the breadth of the wheels were the same in both cases?—I should prefer, with a proper wheel in both cases, the Steam Carriage without the horses, because that question can only be answered with reference to the wheel.

Then, in the case given, if the wheels of the Steam Carriage were four inches and a half, and the wheels of the Coach two and a half, which would do the greatest injury?—The Coach, decidedly, drawn by horses, though only two tons and a half, infinitely more; because I consider, that of all classes of thoroughfare at present, the Stage Coach, as usually laden, does us the greatest injury.

Can you suggest any mode by which Tolls could be fairly charged on Steam Carriages, in relation to the Tolls charged on Coaches?—The mode adopted in Coaches, of taking toll per horse as well as Waggon, has been found to answer every purpose, it being, in truth, a penalty upon weight. If greater weight is put upon a Waggon, a greater number of horses are necessary to move it, and the parties bring the penalty in the shape of toll in their hands. This cannot be applied to Steam Carriages, and I am at a loss to recommend to the Committee any general mode, unless the diameter of the cylinder or power of the Engine could be taken. In the Metropolis Act of 1829, there is a toll laid upon Steam Carriages; any Carriage that shall be in any manner drawn by Steam or Gas, shall pay the toll that would be paid by any Carriage drawn by four horses.

If the power of the Engine is equal to any number of horses you only charge the same toll?—The same toll.

Then if a Steam Carriage drew another Carriage after it, or two Carriages after it, would it be two or three tolls, or one only?—Two or three tolls; where a Steam Carriage conveys passengers by drawing another Coach they would each pay the toll of four horses, this is a matter still in its infancy; in many Acts, such as the Lemsford Mills Act, a toll of half-a-crown was introduced for any Carriage drawn or propelled by Steam.

Would not this inconvenience arise from the Clause you have read in the Metropolis Tolls Act, it would be a premium given in favour of one description of Steam Carriage over another, though the injury done to the road might be in favour of the one less taxed, as in the case of a Steam Carriage carrying 20 passengers, and another Steam Carriage drawing a Carriage containing the same 20 passengers?—In that case the toll would certainly be an unjust one, and require revision; it was a point not settled, and it was put in merely to commence the toll, and call the public attention to it. I beg leave to observe, that if these Carriages come into general use, they would necessarily require a still greater perfection in the surface of our roads, and also in the levelling of the remaining hills; as good surface and little inclination is to them of the greatest importance.

If that is the case, would it not be necessary to lay considerable rate of toll upon those Carriages, for the purpose of affording the means of executing those improvements?—It is found, that lowering the hills, and improving the surface of all the roads, is productive invariably of a great increase of thoroughfare; and although lowering the hills might be attended with the first expense, any excitement that would induce the Trustees of the Roads to keep them in good order, would be at the same time productive of economy, a good road being always the cheapest.

Do you not suppose, if those Carriages were in general use, the very action of the wheels upon the roads would prevent the necessity of such frequent repairs as are required at present?—I should think that the absence of the horses' feet in a great degree upon the roads, would be a very considerable saving; and I have already stated, that these Carriages, with properly constructed wheels, would be the class of Carriages that would do the least injury to the roads.

What is the greatest speed you have known a Carriage drawn by horses to execute a given number of miles on your Trust?—I once, by mere accident, came in the Leeds Union Coach from Grantham, which is 110 miles from London; I got into the Coach at three o'clock, and I was in London at half after one the same morning; that was at the time the Leeds Union and the Rockingham were racing the whole way up.

Are you aware that Mr. Telford states in his Report on the state of the Holyhead Roads, that three of the Birmingham Coaches perform the journey of 110 miles in less than eight hours, without any accident, at the rate of thirteen miles and six furlongs an hour?—I have frequently heard it stated upon the road, though I do not know it of my own personal knowledge.

Have

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Have you any other observations you would wish to make to the Committee?—
I am not aware of any point.

You do not think it will be necessary to limit Steam Carriages to any particular number of passengers, provided the wheels were of the dimensions stated?—If the wheels were of the dimensions and the description stated, I should, in reason, be regardless of weight, experience having completely proved, with properly constructed wheels, we sustain little or no injury from weight.

What is the maximum weight a road would bear upon each wheel?—The injury done by weight upon a road in a Carriage with proper wheels is principally, I might almost venture to say exclusively, to the new coatings; if the weight in such Carriage is a crushing weight, as applied to the materials with which the road is made, it does a very considerable injury, and therefore were Steam Carriages to become in general use, it would be a matter of great importance, that harder material should be introduced, that flint should take the place of gravel, and that granite or whinstone take the place of flint which is the principle acted upon by the Commissioners of the Metropolis Roads, but upon a hard and well consolidated road a very great weight may be sustained without doing comparatively any injury.

When you state that if Steam Carriages come into general use harder materials ought to be used, you suppose that these Steam Carriages will be much heavier than the Carriages used at present?—Yes; I contemplate that they will carry much greater weights.

Your answer does not apply to Carriages that are of the same weight as those now used?—No; but to Carriages of the weight of eight or ten tons; when I spoke of the weight of from eight to twelve tons, I supposed a Carriage with four wheels.

Upon the present well constructed roads what weight do you think could be put upon them without crushing them?—I should not apprehend any injurious result from the general use of Steam Carriages with properly made wheels, carrying upon an average from eight to ten tons.

Your answer refers to roads that are so well made that the whole pressure shall be as that of an arch, but on the average of roads, such as shall be found in the country, would you give the same answer?—No, certainly not.

Taking the average of any line of road for a great number of miles, where materials less capable of bearing weight must necessarily be used for a considerable proportion of that road, what should you say is the maximum weight that should be allowed with reference to the preservation of that road on any one wheel of four inches and a half?—Two tons.

Have you ascertained that by experiment?—I have not had an opportunity of judging of it, except in all the waggons that depart from the Metropolis that are required to have the wheels constructed in the way I have described, some of which carry considerable weights.

Martis, 6^o die Septembris, 1831.

Mr. John Macneil, Civil Engineer, Daventry, called in; and Examined.

STATE your profession?—A Civil Engineer; I am at present the resident and assistant Engineer, under Mr. Telford, to the Parliamentary Commissioners, on the Holyhead Road between London and Shrewsbury, and London and Liverpool.

What is the weight of a Coach, a Van and a Waggon, each carrying what would be considered an average load; state also the breadth of the tires of their wheels?—The weight of four-horse Stage Coaches vary from fifteen cwt. and three quarters to eighteen cwt.; most of the Birmingham day and night Coaches weigh about sixteen cwt. and frequently carry, the night Coaches in particular, upwards of two tons of goods and passengers, exclusive of the Coach; yet, taking into consideration the number of times they travel with very light loads, I should say that from two tons five cwt. to two tons ten cwt., including the Carriage, would be a fair average weight during the year. The tires of the wheels are mostly two inches, but some of them are less; those constructed by Mr. Brown, and used on his patent Coaches have the edges chamfered off, so as to give a flat bearing of one inch and a half, but from the peculiar manner in which those Coaches are mounted with springs, I am inclined to think the injury done to the roads by these wheels is not so great as it otherwise would be. Some coach wheels that I have

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James M^cAdam.

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Mr.
John Macneil.

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Mr.
John Macneil.

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seen are rounded off, so as to form in the cross section a segment of about one inch and three quarters in diameter. The bearing in this case on the road, where the surface is hard and smooth, is reduced almost to a point and must be extremely injurious. The coachmen remark that Carriages with such wheels run wild in descending hills in summer, but heavy in winter, and when the roads are soft and muddy. The Mail Coaches weigh very nearly twenty cwt. Some of them, the Holyhead Coach for instance, frequently carries upwards of a ton of letters and parcels, independent of passengers and their luggage. The average weight of the whole may probably be taken at two tons. Some others, the Liverpool day Mail for instance travel very light, and probably will not average one ton and a half. The breadth of tire of Mail Coaches is two inches and a quarter; the four-horse Vans, which travel about six miles an hour, weigh on an average four tons and a quarter, including the carriage; the breadth of tire of one which I measured was two inches and a half, but I am not prepared to say that this is the general size of such wheels; the horses used in these Carriages are of the very best and largest description, which added to so great a weight on narrow wheels, probably renders this Carriage more injurious to the public roads than any other description of vehicle at present employed. There are four descriptions of Waggon in general use, the eight-horse Waggon, the six-horse Waggon, the four-horse Waggon, and the farm Waggon, which is drawn sometimes by two, three or four horses, according to the load. The eight-horse Waggon, though frequently weighing, with the load, seven tons, may probably be averaged at not more than six tons the year round; the wheel is nine inches in the tire, but from a very improper plan followed in its construction the bearing on a hard solid road is only three inches, for these wheels are generally shod with three hoops of three-inch iron, the centre one of which is of a greater diameter than the others, and projects full half an inch beyond them, which on weak roads, such as in the neighbourhood of London, must be most injurious. I have measured one since I came to London, which travels on the Bath and Bristol road, the outer rim is conical, and can certainly never come in contact with the road surface, unless it be one on which the wheel would sink two or three inches; the section of the wheel is represented in the following sketch: The six-horse Waggon, with their load, generally weigh four tons and a half; their wheels are six inches wide, and of a better description than the former, though sometimes one of their hoops projects beyond the other, as in the case of the nine-inch wheel; the four-horse Waggon, with their load, commonly weigh three tons and a half, their wheels are four inches wide, and are more upright than the others, and have a more level bearing on the road; the farm Waggon, used in Northamptonshire, weighs on an average one ton one cwt., the breadth of a wheel is three inches, and it carries from one ton to three tons, according to circumstances, and lasts nearly twenty years.

On an average line of road of not less than 100 miles, on which in many places materials of very inferior description must have been used, both in its formation and subsequent repair, what is the maximum weight per wheel (say if not less than four inches width of tire) which should be carried on any kind of Carriage (carriage weight included,) without risk of injury to the road?—On a road, such as here described, the injury will be considerable by any wheel passing over it; but without a more defined statement of the quantity and quality of the materials used, I do not think this question can be answered with any degree of certainty; on all gravel roads however made, without a foundation or bottoming, I should say the weight on a four-inch wheel should not exceed fifteen cwt., and on a wheel less than that ten cwt. on the generality of roads, throughout the country; I do not think it would be safe to run a Carriage with almost any width of wheel if the load much exceeded ten tons; in fact there are some bridges even between London and Birmingham, that it would be running a risk to pass over with a Carriage weighing ten tons.

Can you from observation say what proportion the breadth of the tire of wheels should be to the weight?—The breadth of tire, in proportion to the weight, will depend entirely upon the description of road over which the Carriage passes; on such a road as that lately constructed by the Parliamentary Commissioners of the Holyhead and Liverpool Roads, at the Highgate Archway, I have frequently observed Waggon, carrying upwards of six tons pass over it; the weight of each wheel on the road was then about thirty cwt.; and though the bearing of the wheels, from the cause I have before stated, was not more than three inches; the effect produced was imperceptible; the pressure in this case was ten cwt. on every inch

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n ch which is unquestionably too much for the generality of roads; but if we take the road from London to Shrewsbury, as a criterion to judge by, I should say that a wheel ought to be an inch in width for every ton that a Carriage and its load would weigh; and that if every Carriage that now travels that road, was limited not to exceed that proportion, the roads would be better, and maintained at a cheaper rate than at present. According to the average weight of Coaches and Waggon, as before stated, I have calculated the following Table, showing the weight at present carried on each inch of bearing, and what I conceive might be the breadth of the different wheels if they were made cylindrical with an even bearing, and in the proportion of one inch of width for every ton including the Carriage.

DESCRIPTION of CARRIAGE.	Velocity in Miles per Hour.	Weight, on an Average, in Tons.	Breadth of the Wheels, in Inches.	Pressure of each Wheel, in Cwts.	Pressure on each Inch, in Cwts.	Breadth of Wheel, calculated in the Proportion of 5 Cwt. to the Inch.
Mail Coach -	9 to 11	2	2 $\frac{1}{4}$	10.0	4.40	2
Stage Coach -	8 to 11	2 $\frac{1}{2}$	2	12.5	6.25	2 $\frac{1}{2}$
Van - - -	6 to 7	4 $\frac{1}{4}$	2 $\frac{1}{2}$	21.25	8.29	4 $\frac{1}{4}$
Waggon - -	2 $\frac{1}{2}$ to 3	6	9	25.0	2.77	6
Ditto - - -	2 $\frac{1}{2}$ to 3	4 $\frac{1}{2}$	6	22.5	3.75	4 $\frac{1}{2}$
Ditto - - -	2 $\frac{1}{2}$ to 3	3 $\frac{1}{2}$	4	17.5	4.37	3 $\frac{1}{2}$

State your opinion as to the relative wear of a road by two Carriages, both drawn by four horses, one carriage of two tons weight, with two-inch tires, the other four tons, with four-inch tires?—My opinion is, that the wear of the roads would in each case be the same, as far as it was affected by the wheels of the Carriages, probably rather less, by the Carriage carrying four tons, on four-inch wheels, than by the Carriage carrying two tons, with two-inch wheels; but it must be recollected that both the Carriages are supposed to be drawn by the same number of horses, and as the horses drawing the Carriage of four tons must use greater exertions than those drawing the Carriage of two tons, I am of opinion that the aggregate wear of the road would be more by the transit of the four ton Carriage, than by that of the Carriage weighing two tons.

How would the foregoing answer be affected by an increase or decrease of velocity in either Carriage?—If the road over which the Carriages are drawn be hard, solid and smooth, I think there would be very little increase of wear from the effect of the carriage-wheels by an increase of velocity; but if the road should be uneven or rough, there would be an increase of wear, in consequence of the impetus or blow with which the wheels would strike the road, after passing over the inequalities in its surface, particularly if the Carriages were made without springs; but whether the road be a good or a bad one, the wear occasioned by the feet of the horses will be greater when they travel with an increased velocity: for a coach-horse which travels at the rate of ten miles an hour, works on an average 270 miles in a month, and wears out in that time about four pounds of iron in shoes; whereas a waggon-horse, which travels at the rate of three miles an hour, and works twenty-six miles a day, for four days in the week, goes, on an average, 416 miles in the same period of time, and wears out 4.8 pounds of iron. If the coach-horse travels the same distance, the wear would be six-sixteenths, which exceeds the wear of the waggon-horse one-thirty-sixth. In the same way might the relative injury caused by the wheels of the Waggon and the Coach be ascertained.

What is the operation of the atmosphere on roads?—Well made roads, formed of clean hard broken stone, placed on a solid foundation, are very little affected by changes of atmosphere; weak roads, or those that are imperfectly formed with gravel, flint or round pebbles, without a bottoming or foundation of stone pavement or concrete, are on the contrary much affected by changes of the weather. In the formation of such roads, and before they become bound or firm, a considerable portion of the sub-soil mixes with the stone or gravel in consequence of the necessity of putting the gravel on in thin layers; this mixture of earth or clay, in dry warm seasons, expands by the heat, and makes the road loose and open, the consequence is, that the stones are thrown out, and many of them are crushed and ground into dust, producing considerable wear and diminution of the materials; in wet weather also, the clay or earth, mixed with the stones, absorbs moisture, becomes

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becomes soft, and allows the stones to move and rub against each other when acted upon by the feet of horses or wheels of Carriages. This attrition of the stones against each other wears them out surprisingly fast, and produces large quantities of mud, which tend to keep the road damp, and by that means increases the injury.

Supposing the actual wear or deterioration of a road to be represented by 100, and that only Coaches, Vans and Waggons have passed over it during any given period, in what proportion would you estimate the effects; first, of atmosphere; secondly, of the Carriage; thirdly, of the horses?—This question can only be answered in a general way; no two lines of road would probably give results at all similar; much will depend on the manner in which the road is constructed, the materials of which it is composed, the care bestowed on its drainage, and whether it be in an open situation or shaded by trees; if the road be properly made, and in an open situation, the injury arising from the atmosphere will be little, compared with the actual wear caused by the wheels of Carriages and the feet of horses, probably not ten per cent. during the year; whereas on weak roads in clay countries every shower loosens the materials of which the road is composed, and causes considerable wear, perhaps thirty per cent. or even more in some situations, where the road is shaded by trees; to get at something like an average proportion between the wear occasioned by horses' feet and the wheels of Carriages, I have procured the following facts: the Coaches which run between London and Birmingham require an hundred horses on an average, to work the up and down Coach; the horses are generally shod by contract, at about 2s. 6d. per horse per month; those near London are much larger and heavier, and therefore require heavier shoes than those twenty miles out of London, and from thence to Birmingham; near London in the flint districts the wear of horses' shoes is much more than it is in the quartz and limestone countries. At Stony Stratford, the weight of the four shoes of a Mail and Stage Coach-horse averages five pounds, and when taken off at the end of about twenty-eight days they weigh very nearly two pounds: in this period, the horses run 252 miles. At Towcester, Weedon and Daventry the weight of the new shoes is one pound and a half each, and when taken off weigh nearly three-fourths of a pound; the length of time which they remain on is about thirty days; this would give a wear of three pounds per horse per month, but if the greater wear near London be considered, I think it would not be too much to allow the wear equal to four pounds per horse per month, which for 100 horses for ten weeks would give a wear of 1,000 lbs. of iron. The hind wheels of the Coaches are mostly four feet eight inches in diameter, and the front wheel three feet. The width of tire, I before stated is about two inches, and when new, the thickness of the iron is three quarters of an inch. These wheels are found to last from two to three months, according to the state of the weather, the workmanship and quality of iron, (about twenty years ago they did not last seven days on an average;) suppose they now last ten weeks, in that time the tire is worn down to one-sixth of its original thickness; this would be equal to 163.4 lbs. or 326.8 for both Coaches; this would be to the wear of the horses' shoes as 326.8 to 1,000, or as 1 to 3.14ths nearly; now if the injury done to the road by the horses' feet and the wheels of Carriages be estimated in the same proportion, I think it would probably be near the actual effect produced; that is to say, the injury done by the wheels of fast Coaches is to the injury done by the horses which draw them as one to three in round numbers. The effect produced by slow Carriages and horses is different; a Waggon drawn by four horses, which travels regularly from London to Daventry at the rate of three miles an hour, is worked by fifteen horses; the waggon weighs twenty-five cwt. and carries on an average sixty-seven cwt.; the hind wheels are four feet eight inches in diameter, and the front ones four feet; the breadth of the wheels is six inches; they are nearly upright but not cylindrical; the iron tire, when put on, weighs on the fore wheels, 285 lbs., on the hind ditto, 356 lbs., making 621 lbs. When removed, the weight is on the fore wheels, 144 lbs., on the hind ditto, 168 lbs., making 312 lbs.; wear in five months, 309 lbs. The number of miles travelled in this time is 6,048; the shoes that are put on the horses employed to draw this Waggon, weigh when new from two pounds and a half to three pounds each; the average of a great many gave two pounds and three quarters, and when removed one pound and a quarter; they last from four to six weeks, according to the weather and state of the road; but we may assume five weeks as an average, and the wear in that time for each horse six pounds, and for fifteen horses for five months, it would be 360 lbs. The proportion in this case would be as 309 to 360, or as one to 1.16 or nearly one to

1½; on the generality of roads therefore, I would say the proportion of injury would be nearly as follows, when travelled by fast Coaches:—

Atmospheric changes	-	-	-	-	20
Coach wheels	-	-	-	-	20
Horses' feet that draw them	-	-	-	-	60
					100

and when travelled by Waggon:

Atmospheric changes	-	-	-	-	20
Waggon wheels	-	-	-	-	35.5
Horses' feet that draw them	-	-	-	-	44.5
					100

What is the effect of travelling by coaches and horses; whence and in what proportion does the injury or deterioration arise; the crushing of materials; their actual wear; their displacement?—If the wheels of Carriages be properly constructed, and cylindrical, the friction, and consequently the wear, on the surface of a well-made road, will be very little, and there will be no injury from displacement of materials, except what may arise from the few surface-stones that will sometimes be started out by the feet of horses on steep hills, when they are obliged to exert a great force to draw up a heavy load. When stones are thus thrown out on a hard and solid surface, the wheels of heavy Carriages will crush them, and cause an injury which would be much more than that caused by the actual wear of the wheels passing over the surface. If the roads be weak or elastic, and bend or yield under the pressure of the wheels, the particles of which it is composed will move and rub against each other, or perhaps break by the action of heavy wheels over them. On such roads, I conceive the injury caused by Steam Carriages will be much greater in proportion to the injury caused by light Carriages drawn by horses, than it will be on solid firm roads. In one instance, where an accurate experiment was made, the wear was found to be four inches of hard stone, when it was placed on a wet clay bottom, while it was not more than half an inch, on a solid dry foundation, (formed as described in the Report of the Select Committee on the Holyhead Road, on the 30th May 1830,) or with a pavement bottom, on a part of the same road, when it was subject to the same traffic. On the Highgate Archway Road before mentioned, the annual wear does not appear to be more than half an inch in depth. Now as this road is very little affected by wet, in consequence of its peculiar construction, and the care bestowed on its drainage, I attribute almost the whole of the diminution of materials to actual wear. On many roads, where the sides are weak, great injury arises from the crushing of materials, particularly by the action of waggon-wheels. In frosty weather, weak roads very frequently suffer more in one month than all the rest of the year. In such cases, the injury is caused by the wheels of Carriages, and not by the horses' feet.

If 30 lbs. be sufficient to move a Carriage of 21 cwt. 8 lbs. on a level platform, little affected by friction, and 266 lbs. be required to move the same Carriage up an inclination of 1 in 10, the pressure in the one case being exactly the weight of the Carriage, 21 cwt. 8 lbs. what would be the pressure on the road; or platform; on the inclination?—As the pressure on the horizontal is to the pressure on the inclined plane, as the length of the plane is to its base, we have this proportion, $\sqrt{b^2 + p^2} : b :: W :$

$\frac{wb}{(b^2 + p^2)^{\frac{1}{2}}} =$ the pressure on the plane. In this example, $w = 2360$. $b = 10$. $p = 1$,

which gives $\frac{wb}{(b^2 + p^2)^{\frac{1}{2}}} = \frac{2360 \times 10}{\sqrt{100 + 1}} = 2349.5$ lbs. or $10\frac{1}{2}$ lbs. less than the pressure on the horizontal.

Taking twenty miles near London, 150 lbs. appears to be the average force actually engaged in drawing the Carriage of 21 cwt. 8 lbs. including hills, would the force required to draw a carriage of 42 cwt. 16 lbs. be on an average 300 lbs. and so on in proportion; the extreme traction of the Carriage being 343 lbs. what on this road would have been the maximum force required to draw a Carriage of four tons weight?—It does not follow that because a Carriage is twice as heavy as another, that its draught would be twice as much; the resistance arising from gravity

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on the inclined planes would, abstractedly considered, be double, but that part of the resistance arising from the friction and penetration of the wheels into the surface materials, would much depend on the construction of the Carriage, and its wheels, and the different sorts of roads over which it was drawn. In order to ascertain the average draught of a Carriage of 42 cwt. 16 lbs. over the above road, I conceive that the friction of the surface or resistance opposed to the motion of such a Carriage, should be ascertained on each description of road within the above limits, and then by knowing the rates of acclivity, or the amount of gravity acting on each, the average draughts might be ascertained, if the same Carriage and wheels were used, but loaded so as to make up 42 cwt. 16 lbs. the average draught. It might probably be calculated pretty nearly from the following Table of Experiments, which as it may be of use in the present inquiry, I here beg leave to hand in; but it must be remembered that the proportions given in this Table between the increase of weight and the increase of draught, will not be the same on every description of road. To be enabled to answer the second part of the question, it will be necessary to know the rate of acclivity on which the draught of the Carriage weighing 21 cwt. 16 lbs. was 343 lbs., and also to know the draught of the four ton Carriage on the horizontal; but even then a difference might arise from the construction of the Carriage, and the situation of its centre of gravity.

TABLE of EXPERIMENTS made on the 28th January 1829, immediately after a rapid thaw, the mud was full one and a half or two inches thick on the Road at the time.

TABLE I.

No. of PLANES.	Waggon Empty, weight 1 Ton.		Half a Ton in the Waggon.		1 Ton 2 Cwt. in the Waggon.	
	Down.	Up.	Down.	Up.	Down.	Up.
1	30	99	45	145	58	210
2	64	88	105	120	125	150
3	75	85	115	120	135	155
4	75	85	105	115	135	155
5	80	88	105	125	135	165
6	85	93	105	135	135	170

Neither the rates of acclivity, or the lengths of the planes, were taken at the time, but it might still be done if thought necessary by the Committee, as the points are well ascertained.

EXPERIMENTS made on a Horizontal Timber Platform in January 1829.

TABLE II.

Weight of the Waggon and Load.	Powers required in Lbs. to move it.	Difference between Empty Waggon and Load.
2,240	29	
2,800	74	45
3,360	104	75 ³⁰
3,920	140	111 ³⁶

If 266lb. be required to move a Carriage of 21 cwt. 8lbs. up an inclined plane of one in ten, what amount of weight would be required to keep the Carriage stationary, or to allow it to descend with the slowest possible motion on the same inclination; this question has reference to the injury done to roads by "dragging" the wheels, and subsequently to the slow motion of the propelling wheels of Steam Carriages in descending hills?—If the base of the inclined plane be 10, and its height 1, the length will be $\sqrt{10^2 + 1^2} = \sqrt{101} = 10.05$ nearly, and we have the proportion $10.05 : 1 :: 2360 : 234.82$ lbs, the weight which would be required to keep the Carriage

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Carriage stationary if the surface of the plane was hard and smooth, and the mass collected in a point; but as 266 is stated to be the moving power, the resistance arising from the friction of the surface, and the axle-trees would in this case be 31.18lbs.; it may be well to observe here, that the experiments made, on inclined planes, as detailed in the Seventh Report of the Parliamentary Commissioners of the Holyhead and Liverpool Road, were not intended for any thing further than to get practical results, the description of which could be easily understood by Road Surveyors and their Assistants, and even by men in the habit of driving Coaches; it could not be expected that experiments made with a large unwieldy waggon, mounted with common axle-trees besmeared with tar, could furnish results on which to found a refined mathematical calculation. I have however, within these few days, commenced a series of experiments, with a small Carriage constructed on purpose, and furnished with a very delicate instrument for measuring the draught. From the little way I have as yet gone in these experiments I cannot furnish any details at present; but I think I am warranted in saying that a very great benefit would arise in the saving of road-materials, by the adoption of a better method of hanging the Coaches, in a manner, perhaps, something similar to gentlemen's Carriages. Many of these weigh, when fully loaded, two tons, yet a pair of post-horses draw them with apparent ease, the rate of ten miles an hour; and on some parts of the road between London and Birmingham, where the road is tolerably level, at a much greater speed, some of the Birmingham and London Coaches travel the same ground, at twelve miles, and sometimes fifteen miles an hour. This velocity, however, may in a great measure be attributed to the level and perfect state of that road.

The details of various kinds of Steam Carriages have been given to the Committee; all act without propellers; without projection on the wheels, with cylindrical wheels; some with greater or less breadth of tire, even six inches wide; the power is applied either by crank or wheels to one or two propelling wheels, according as greater or less force may be required. Some of the experimental Carriages had three, some six wheels; all will have four wheels. Some have the Engines in a separate Carriage, and draw the load; some carry the load and Engines on one Carriage. Taking the above circumstances into consideration, which would be most injurious to a road—a Stage Coach, drawn by four horses, weight of Coach three tons, horses two tons, breadth of tire two inches and a half; or Steam Coach, wheels four inches tire, weight four tons; in both cases velocity ten miles per hour?—Taking for granted that the injury which a road sustains by the wheels of Carriages and the feet of horses is proportional to the wear of iron on the wheels and on the horses, and that the statement before given as to the actual wear on each be found correct, I would say, the injury done to the road by the Steam Carriage weighing four tons with four-inch wheels, would be less than that occasioned by the Coach weighing three tons, drawn by four horses.

Would it be beneficial or otherwise to the roads, that Steam Carriages drawing heavy weights in Carriages attached to them should be substituted for Waggons drawn by horses, supposing that the weight of the drawing or propelling Carriage should not in any case exceed the weight of the number of horses that would have been used to draw a corresponding weight, *e g.*

Waggon	-	-	-	-	8 tons
Eight horses, 15 cwt. each	-	-	-	-	6 ditto
					14
On Steam Carriage	-	-	-	-	4
Carriage drawn	-	-	-	-	10
					14 ?—

I am of opinion, that if the Steam Carriage and its accompanying Carriage be constructed with wheels of a proper width, and of the same diameter as the Waggon wheels, and travel with the same velocity, that the injury on well-made solid roads will not be more than that caused by the Waggon and horses; in fact, if the proportion of injury before stated be correct, it will be less; but it must be recollected that weak roads suffer more than solid ones from the heavy pressure of wheels, and in such cases the Steam Carriage and its tender would be more injurious.

In descending hills, Steam Carriages can regulate their velocity by reducing the action or number of revolutions of the wheels; this acts as a drag, but with the

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advantage to a road that the wheel moves continually round; which would be most injurious to a road, the descent of a Carriage dragged as usual (not omitting the operation of the horses' feet,) or the Steam Carriage dragged or regulated in the mode described?—Not having seen a Steam Carriage descending a hill in the manner described (that is, regulated by the action of the Engine on the wheel,) I cannot give a satisfactory answer to this question; but as far as opinion goes, I should say that the joint action of the horses and drag would be more injurious than the Steam Carriage, the motion of which was regulated in the above manner, provided the wheels were of the proper width, and the total weight not greater than that of the coach and horses.

Various local Acts have passed, placing excessive tolls on Steam Carriages, it may be requisite to introduce a general Bill, which shall, on such roads, place Steam Carriages on a fair equality (so far as their relative injury or wear of road to common Coaches on each such road; the toll on a Coach on such roads may vary from one to two shillings, according to local circumstances, on a Waggon in the same proportion; what standard of charge would you suggest for Steam Carriages?—It has been stated to us, that one Steam Carriage has drawn a Carriage containing as many as thirty passengers, at the rate of even ten miles per hour, and nine tons weight at the rate of five miles per hour, but with smaller wheels, what regulation would you suggest as to the breadth of tire; or should tolls be chargeable in inverse proportion to the breadth of tire?—The toll which Carriages propelled by Steam, or by any other mechanical means, should be required to pay, ought, in my opinion, to be in proportion to the injury they would do to the roads, compared with that done by the present description of Carriages and the horses employed to draw them, without reference to the weight or quantity of goods carried; but as I before stated, I do not believe an accurate estimate can be at present formed as to the injury that roads may sustain from Steam Carriages, compared with the injury done to them by Coaches drawn by horses; it may, however, I think be safely assumed, that the injury done to a road by a Steam Carriage would not be greater than that occasioned by a Stage Coach drawn by horses, the weight of the Engine and its load being supposed not to weigh more than the Stage Coach, together with its load and horses; if this be granted, and an Act passed limiting the width of wheel in a certain proportion to the weight carried, there would not be much difficulty in arranging a scale of tolls applicable to Steam Carriages, which would put them on an equitable footing with Carriages drawn by horses; if, for instance, a proportion, such I have already mentioned be adopted, viz., that a wheel should be an inch in width for every 5 cwt. it has to support, and a toll charged for each inch equal to the amount charged for a horse drawing in a Carriage which travels with the velocity of the Engine, it would, in my opinion, be a fair and equitable toll at least for some years, or until a correct proportion of injury was ascertained by experience and observation, when it might be altered or amended according to circumstances. This mode of charging toll would be extremely simple, and not likely to be misunderstood by toll-collectors, or to occasion any disputes; but there should be a heavy penalty attached to the proprietors of Steam Carriages if they put a greater weight on the Carriage than the wheels were intended to carry. If the Engine, instead of carrying the load draws one or more Carriages after it, the toll should be collected and charged on each Carriage, in a similar manner as it is charged on the Engine, that is in proportion to its wheels. An example will illustrate my meaning more clearly; suppose an Engine, together with its load, to weigh nine tons (which is about the average weight of two Stage Coaches, including the weight of the horses which draw them) to pass through a toll-gate where horses drawing Coaches are charged 6*d.* each, the toll on the two Coaches would be 4*s.*, and of the Steam Carriage 4*s.* 6*d.* Suppose that the Engine, instead of carrying the load draws a Carriage after it, and that the weight of the Engine is five tons, with five-inch wheels, and of the accompanying Carriage four tons, with four-inch wheels, the toll of the Engine would be 2*s.* 6*d.*, and of the tender 2*s.*, making 4*s.* 6*d.* as before. The only objection I can see to this mode of charging toll on Steam Carriages travelling over the turnpike roads would be, that in the event of their being able to carry a greater number of passengers at a cheaper rate than the present description of Carriages drawn by horses, it would lessen the amount of toll collected, as a fewer number of Carriages would do the work, and many persons who drive their own horses would travel by them if found cheaper to do so; and this circumstance, although it would not affect the state of repairing in which the road was previously maintained, it might lessen the value of

of property invested in the different turnpike trusts throughout the kingdom, which is a very considerable sum ; but such a circumstance should not militate against an invention likely to prove beneficial to the country at large.

Give your opinion on the probable extent of injury to roads from Steam Carriages?—Generally speaking, I should say that the injury roads will sustain by the introduction of Steam Carriages will be much less than is commonly supposed ; but the actual amount of injury, or correct estimate of the comparative injury that will be done by a Steam Carriage cannot, in my opinion, be formed at present with any degree of certainty. Experience alone will decide the point. The only danger, in my mind, that is to be apprehended, is the injury which roads may sustain by the possibility of the wheel which is acted upon by the Engine, turning round without propelling the Carriage, in which case the road would suffer considerably ; and this would take place, if a train of Carriages were attached to the Engine, the draught of which was more than the friction or gripe of the Engine-wheel on the surface of the road. As long, however, as the weight is carried by the Engine, and not drawn after it, nothing of this kind will take place, even on our steepest hills.

Have you communicated your conclusions on these subjects to Mr. Telford?—I have.

Does he coincide with you?—Quite so.

You stated, that the only probable injury to the roads from the travelling of Steam Carriages, would be the slipping of wheels ; would it not be directly against the interest of the proprietor that the wheels should slip in any degree, there being a necessary loss of power every time they do slip?—Clearly so.

From your observations of the effects produced by heavy Carriages drawn by horses, in ascending and descending hills, what would be the effect, under similar circumstances, of a Steam Carriage of a weight equal to the weight of the coach and horses?—I am of opinion that the effect or injury to a road would be less by the Steam Carriage ; for when hills exceed a certain rate of inclination, gravity overcomes the friction of the surface, and the Carriages, in descending, press upon the horses, unless a drag be applied to one of the wheels. This, in itself, injures the road, but not so much as when no drag is used, because the horses are then obliged to bear against the Carriage, and set down their feet very strongly ; this often tears up the surface, particularly of weak roads. The time that is lost by the Coaches in descending some of the hills on the road between London and Birmingham, is full as much as is lost in ascending them, besides the imminent danger, even with the greatest caution on the part of the drivers. If proper springs were used, the draught would be lessened, and of course the injury to the road would be much diminished.

On every road there are numerous six-horse Waggon ; you state the weight to be four tons and a half, the horses weighing four and a half more, making nine tons, should any objection be taken to a single Steam Carriage of this weight, or from nine to ten tons, provided the wheels be of a proper description?—No ; I think in the general state of roads, a Steam Carriage of from nine to ten tons could run with perfect safety, without injury to the roads, if it was constructed with proper wheels.

The above question refers to a Steam Carriage carrying its load ; if the Engine Carriage were of the weight of four tons, drawing a second Carriage of the weight of six tons, thus dividing the weight over eight wheels, would the effect on the road be less injurious provided it was four and a half tire?—I think the injury would be less, provided the Engine had the power to propel itself, and draw a Carriage with six tons after it, without a slipping of its wheels.

Carrying this principle further, if the load were divided into two Carriages, each to weigh three tons, thus dividing the load over twelve wheels, would not less injury still be done?—Decidedly, particularly on weak roads.

If under these circumstances you can diminish the pressure on the road by multiplying the number of wheels, should not care be taken so to frame the tolls to be levied as not to discourage the use of those Steam Carriages, whose greater number of wheels could be least injurious to the roads?—I think that would be regulated by the mode I have suggested of charging toll.

Have you seen Mr. Gurney's Carriage, and examined its effect on the roads?—I have seen it.

What state were the roads in, at what velocity was it going, how many persons did it carry, and what was its weight?—I do not know the weight of the Carriage, there appeared to be eight or ten people on and about it ; the road on which I saw

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it was excessively bad, one of the worst in the country; the velocity was probably five or six miles an hour.

Were there other loaded Carriages passing along the road at the same time?—Several; both Coaches and Waggon.

Did you remark the effect of the Steam Carriage on the road, to see that it did less or greater injury than the other Carriages?—I could not perceive any difference.

If there had been any great difference, you would have perceived it?—As far as leaving a track behind, which would have been perceived, I could not ascertain the amount of injury; it was nothing more than that done by common Coaches.

Do you think it essential that the wheels of Steam Carriages should follow in the same track, provided they have a proper breadth of tire?—Not at all, as regards the injury to the road; it would require more power to work them if the wheels did not follow in the same track.

Supposing the Steam Carriages, either the propelling Carriage and the Carriage drawn, or the Engine Carriage carrying the passengers were generally to be four tons, what would you recommend to be the minimum breadth of tire to either of the Carriages?—In the present state of Steam Carriages, as applied to the working over turnpike roads, I should say you might limit them to not less than four inches for a few years.

Supposing their average weight never exceeded from six to eight tons, do you think four and a half would be a safe minimum?—I am inclined to think it would be rather too little.

Do you think it would be necessary to make any alteration in the form of the present line of turnpike road for the facility of working by Steam?—I do not think it would be absolutely necessary; it would, however, be of great benefit to the country and every person in it, if the hills on the present lines of road were more reduced and the surface strengthened; no road should have a greater ascent than one in thirty or one in thirty-five; in almost every instance the expense would be saved in horse-labour in a few years: the following Table will show pretty nearly the increase of expense in transporting goods by stage coaches drawn by horses up planes of different rates of ascent. Roads in general have, in some parts, steep ascents; one in fifteen between this and Birmingham, for instance, is too much on a road of such traffic. The surfaces are not so good generally as they ought to be; the roads should be strengthened, either with a pitched bottoming of stone or a concrete mass, such as the Highgate Archway, or the new road near Coventry.

T A B L E.

EXPENSE of drawing One Ton over One Mile at different Rates of Acclivity,
by a STAGE COACH and WAGGON.

Four-Horse Stage Coach, Average Velocity, 10 Miles per Hour.		Waggon, Four Horses, Average Velocity, 2½ Miles per Hour.	
Rates of Acclivity.	Pence and Decimals.	Rates of Acclivity.	Pence and Decimals.
	d.		d.
1 in 10	77.24	1 in 10	52.07
1 in 15	57.78	1 in 15	28.70
1 in 20	50.47	1 in 20	22.83
1 in 30	44.15	1 in 30	18.55
1 in 40	41.25	1 in 40	16.79
1 in 50	39.56	1 in 50	15.82
1 in 60	38.46	1 in 60	15.20
1 in 70	37.68	1 in 70	14.77
1 in 80	37.09	1 in 80	14.46
1 in 90	36.64	1 in 90	14.22
1 in 100	36.28	1 in 100	14.04
1 in 150	35.19	1 in 150	13.46
1 in 200	34.64	1 in 200	13.18
1 in 300	34.09	1 in 300	12.91
1 in 500	33.65	1 in 500	12.69
1 in 1,000	33.32	1 in 1,000	12.53
Horizontal	32.98	Horizontal	12.36

What

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What would be the difference of expense of pavement and forming a good granite road, in the neighbourhood of London; say twenty miles?—If you take twenty miles, and also take the repairs of the roads for twenty years into account, I should say paving would be the cheapest. The great defect of all the London pavements arises from want of a strong and firm foundation. In Fleet-street, and some others, this has been partly accomplished of late, but certainly not as perfect as it might be. If on the road from this to Birmingham there was a portion laid off on the side of the road for Steam Carriages, which could be done without difficulty, and if it be made in a solid manner with pitching and well-broken granite, it would fall very little short of a Railroad. My only reason for keeping it distinct from the other road, is the evident injury every road sustains from horses travelling over it and breaking up the surface, and the Steam Carriages would be able to go with greater velocity if they were not interrupted with droves of cattle; besides, it would be easy to fence it off from fifteen to twenty feet, without injury to property; and the expense of making a solid road of twelve or fifteen feet would not be very considerable.

But have you any doubt whatever that Steam Carriages can be brought into practical use, with great benefit to the public, even on the present lines of turnpike roads?—I am quite convinced they can.

Would the wear of such roads as you have described, be much affected by the greater or less velocity of the Steam Carriages?—It would be hardly affected at all, on a good road, by increased velocity; if any thing perhaps rather less.

Do you propose in your scheme of toll that weight should be the basis of toll, but that the wheel be an index to the weight?—Yes, that is the principle on which I have suggested the scale of tolls.

How would you check the frauds of proprietors of Steam Carriages, by their placing a greater weight in proportion to the breadth of tire?—I conceive the use of the Steam Carriage would be for passengers solely and their luggage; if the weight was ascertained in the yards at London, Birmingham, or Shrewsbury, the intermediate traffic would differ very little, for persons going short distances would go by the Coaches as at present.

Would you suggest that a license should be granted to Steam Carriages, limiting the number of passengers they should take in proportion to the breadth of tire of the wheel?—I think it would be quite as much as the Road Trustees could expect; and by marking in large characters the width of wheel on the Carriage, it would be a great preventive to the proprietors altering the wheels.

Do you think that considering the infant state of this invention, that the Road Trustees would practically suffer any great injury or inconvenience by merely for two or three years placing Steam Carriages, whatever weight they may be, on a level with ordinary Carriages, with reference to the toll charged for them?—Considering the present imperfect state of Steam Carriages for turnpike roads, I think it would do no injury to Road Trusts if such a regulation was adopted.

Would you place Steam Waggons on the same footing as Waggons drawn by horses?—Yes, provided the wheels are made as I described in proportion to the weight; there should be the same toll on a Waggon drawn by steam as a Waggon drawn by horses, that is, the width of wheel should be charged per inch as the horses are now charged.

Should a Steam Waggon be licensed as to its weight, in the same manner as a Steam Coach?—I think just the same.

Did you conduct the experiments made on the Holyhead Road as to the force of traction required on different inclinations?—I did.

Were they carefully made or otherwise?—They were carefully made as far as the materials would allow; the Waggon was a very large one, with common axle-trees; the result in some cases differed from two to three pounds; on the whole I should say the results stated in that Report do not exceed in any case five pounds beyond what they would be found if proved by the best practical instruments, and are confirmed by my subsequent observations and experience; the object we had in view, by these experiments, was to show to the Trustees and the Surveyors of the roads, that a road might appear a very good one, and still not be one adapted for traffic. By these means they have perceived the defective parts in the road; and within three months after the Report of the Parliamentary Commissioners became public, there was not a hedge on that part of the road where the draught was shown to be excessive, that was not cut down and improvements made on the surface.

When you followed Mr. Gurney's Carriage, did you perceive that any horses

were frightened, or any inconvenience arose to passengers on the road?—I did not perceive the least inconvenience; I saw several horses pass, both gig and saddle-horses, also coaches, and not one took the least notice of it.

Veneris, 9^o die Septembris, 1831.

Colonel *Torrens*, a Member of the Committee; Examined.

Colonel *Torrens*,
M. P.

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HAVE you considered the effect which will be produced upon British agriculture, by substituting, on common roads, Steam Carriages for Carriages drawn by horses?—I have.

What do you conceive that effect would be?—I think it would produce very beneficial effects upon agriculture.

State your reasons for believing that agriculture will be benefited by substituting inanimate for animal power, consuming the produce of the soil?—I conceive that agriculture is prosperous in proportion as the quantity of produce brought to market exceeds the quantity expended in bringing it there. If Steam Carriages be employed instead of Carriages drawn by horses, it will be because that mode of conveyance is found the cheapest. Cheapening the carriage of the produce of the soil must necessarily diminish the quantity of produce expended in bringing a given quantity to market, and will therefore increase the net surplus, which net surplus constitutes the encouragement to agriculture. For example, if it requires the expenditure of two hundred quarters of corn to raise four hundred, and the expenditure of one hundred more on carriage, to bring the four hundred to market, then the net surplus will be one hundred. If, by the substitution of Steam Carriages, you can bring the same quantity to market, with an expenditure of fifty quarters, then your net surplus is increased from one hundred to one hundred and fifty quarters; and consequently, either the farmer's profit or the landlord's rent increased in a corresponding proportion. There are many tracts of land which cannot now be cultivated, because the quantity of produce expended in cultivation and in carriage exceeds the quantity which that expenditure would bring to market. But if you diminish the quantity expended in bringing a given quantity to market, then you may obtain a net surplus produce from such inferior soils, and consequently allow cultivation to be extended over tracts which could not otherwise be tilled. On the same principle, lowering the expense of carriage would enable you to apply additional quantities of labour and capital to all the soils already under cultivation. But it is not necessary to go into any illustrative examples to explain this, it being a well-known principle, that every improvement which allows us to cultivate land of a quality which could not previously be cultivated, also enables us to cultivate in a higher manner, lands already under tillage.

If horses were displaced from common roads, would not the demand for oats, beans, and for pasture, be diminished, and land thereby be thrown out of cultivation, and labour out of employment?—If Steam Carriages were very suddenly brought into use, and horses thereby displaced, I think the effect stated in the question would be produced for a time; but practically, Steam Carriages can be introduced only very gradually, and the beneficial effect upon the profits of trade, by bringing agricultural produce more cheaply to market, will tend to increase profits, to encourage industry, and to enlarge the demand for labour; so that by this gradual process there will probably be no period during which any land can actually be thrown out of cultivation, the increasing population requiring all the food which horses would cease to consume. With respect to the demand for labour, that demand consists of the quantity of food and raw materials which can be cheaply obtained; and as by the supposition the displacing of horses will leave at liberty more food and more material, the demand for labour will ultimately be greatly increased instead of being diminished. It has been supposed, I know not how accurately, that there are employed on the common roads in Great Britain, one million of horses, and a horse, it is calculated, consumes the food of eight men. If Steam Carriages could ultimately be brought to such perfection as entirely to supersede draught horses on the common roads, there would be food and demand for eight millions of persons. But when we take further into consideration, that lowering the expense of carriage would enable us to extend cultivation over soils which cannot now be profitably tilled, and would have the further effect of enabling

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us to apply, with a profit, additional portions of labour and capital to the soils already under tillage, I think it not unfair to conclude, that were elementary power on the common roads completely to supersede draught horses, the population, wealth and power of Great Britain would at least be doubled.

There are soils which are stated to be so poor, that oats alone can be raised upon them, would not the substitution of Steam for horse power have the effect of throwing out of employment the labour required for the cultivation of such lands? — If there are soils of such a peculiar quality that oats is the only marketable product which they will yield, the persons employed in cultivating those lands would certainly be thrown out of that particular occupation; but the extension of tillage over other lands not of this peculiar quality, would create a demand for labour which would much more than absorb the persons thrown out from the culture of oats upon that land which would grow nothing else. But I doubt of there being any land which it is profitable to cultivate, which would not raise some other agricultural produce than oats either for man or cattle, for which the increasing population would create a demand.

The general impression on the minds of the Committee is, that Steam Carriages will, at least for the present, rather be substituted for horses used in conveying travellers than for the conveyance of bulky articles. Do you think that the substitution of Steam in this manner will be injurious to agriculture, and to the demand for labour without any adequate compensating advantages? — Upon the case supposed, namely, that Steam Carriages should be employed in conveying passengers only, and the whole change to be effected in a sudden manner, I think that there would in the first instance be a diminished demand for agricultural produce, but the following process would take place. As the demand for agricultural produce was diminished, the price of such produce would fall, food would become cheaper, and the cheapening of food would benefit partly the labouring class and partly the capitalists, the one obtaining higher real wages, and the other higher profits; this increase in real wages and in profits, would effect a great encouragement to manufacturing industry, and would necessarily lead to an increase in the manufacturing population, and to the amount of capital employed in manufactures. The consequence would be, that after some degree of pressure upon agriculture, the increased number of human beings would create the same demand for agricultural produce which the employment of horses formerly created. So that even upon the extreme and most improbable supposition, that Steam Carriages should never be employed in conveying agricultural produce to market at a cheaper rate, still the benefit to the country would be very great, inasmuch as we should have a vastly increased industrious population, and England would become much more extensively, than she is at present, the great workshop of the world. In point of fact, superseding horses by mechanical power, would have precisely the same effect in increasing the population and wealth of England, as would be produced were we to increase the extent of the country by adding thereto a new and fertile territory, equal in extent to all the land which now breeds and feeds all the horses employed upon common roads. Such addition to the extent of fertile territory in England suddenly effected, would in the first instance lower the value of agricultural produce, and be injurious to the proprietors of the old portion of the territory, but no person would therefore contend that if we could enlarge the Island of Great Britain by additional tracts of fertile land, the public interests would be injured by such enlargement; this would be monstrously absurd. It is not less absurd to object to the increase of food available for human beings, by substituting mechanical power for horses.

In addition to the advantages you have already anticipated from the introduction of Steam conveyance, would not the increased speed and cheapness of intercourse occasion vast public benefits in which agricultural capitalists and labourers must greatly partake?—Certainly.

As it is impossible to conceive that Steam should be generally substituted for horses, and be confined only to the conveyance of travellers, and, as it would necessarily be employed as Vans and Coaches are at present, for the speedy conveyance of light goods as well as travellers, (by the hypothesis Steam Carriages being cheaper than horse draft, or it would not be used), would not such cheapening of the conveyance of such goods have a considerable effect upon the demand for them, and thereby for labour and food?—On the principles that have been already stated with respect to agriculture, the cost of bringing all things to market is comprised of the cost of production and the cost of carriage. Reducing the cost

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of carriage is precisely the same thing in its effects as reducing the immediate cost of production, consequently the conveyance of light goods by Steam power, must cheapen all such goods to the consumers. This will necessarily enable them to consume a greater quantity of such goods, and the consumption of the greater quantity will enlarge the demand for labour, call a larger manufacturing population into existence, and thereby re-act on agriculture by increasing the demand for food. This cheaper mode of internal carriage will not only lower the price of light and refined manufactures to the Home consumer, but will lower their price also to the Foreign consumer. This will increase the advantages which we at present possess in the Foreign market, and tend to increase our Foreign commerce. So that here again there will be an increased demand for manufactures and for a manufacturing population, and here again will be another beneficial re-action upon the soil. So that the more we contemplate the various effects produced upon the industry of the country by a cheaper mode of conveyance, the more we must be convinced that wealth and population will be increased, and that agriculture instead of being injured must necessarily partake in the increased prosperity of the country. In addition to what I have already stated, the saving of expense and of time in conveying passengers and goods, and the rapidity of communication will produce effects, the amount of which it would be almost impossible to calculate.

L I S T.

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APPENDIX.

Appendix (A.)

ANSWERS to QUERIES submitted by the COMMITTEE to
Mr. John Macneill.

QUERY 1.—WHAT is the greatest weight, in proportion to its own weight, which any Locomotive Steam Engine has been found capable of drawing upon a Rail Road, and at what velocity?

IN the first edition of Mr. Nicholas Wood's Treatise on Rail Roads, published in 1825, he states that a Locomotive Engine, weighing $6\frac{1}{2}$ tons, and containing one ton of water, equal to $7\frac{1}{2}$ tons, dragged twelve loaded Carriages, each weighing 9,408 lbs. up a plane ascending 134 inches in 1,164 feet, and also the conveying Carriage, weighing $1\frac{1}{2}$ tons, the wheels not slipping, the rails dry.

He also gives the following experiments made on the Killingworth Rail Road:—The length of plane was 2,260 yards, with an ascent in one direction of 6 feet 5 inches, not uniform, varying from a dead level, or slightly undulating, to an ascent in one place of 1 in 330. Edge Rail, $2\frac{1}{2}$ inches broad on the surface; Carriages all the same construction, weighing $81\frac{1}{2}$ cwt. each, wheels 34 inches diameter, axles $2\frac{3}{4}$ inches diameter.

Experiment 29.

Wheels, three feet; nine Carriages, weighing $731\frac{1}{4}$ cwt., were drawn up the plane fourteen times in 317 minutes, and fourteen times down the plane in 258 minutes; distance traversed, 36 miles in 9 hours, 35 minutes; coals consumed, 2,534 lbs.; water, 890 gallons.

Experiment 30.

Wheels, four feet; nine Carriages, weighing $731\frac{1}{4}$ cwt., were drawn up the same plane nineteen times in 302 minutes, and nineteen times down the plane in 265 minutes; distance traversed, 48.8 miles in 9 hours, 27 minutes; coals consumed, 2,534 lbs.; water, 854 gallons.

Experiment 31.

Wheels, four feet; twelve Carriages, weighing 975 cwt., were drawn up the plane nine times in 155 minutes, and nine times down in 133 minutes. Distance traversed, 23 miles in 4 hours. 48 minutes; coals consumed, 1,546 lbs.; water, 452 gallons.

Experiment 32. (With a different Locomotive Engine.)

Wheels, three feet; nine Carriages, weighing $731\frac{1}{4}$ cwt., were drawn up the same plane ten times in 212 minutes, and ten times down in 180 minutes. Distance, 26 miles; time, 6 hours, 32 minutes; coals consumed, 1,487 lbs.; water, 490 gallons.

Experiment 33.

Wheels, four feet; twelve carriages, weighing 975 cwt., were drawn up the plane five times in 45 minutes, 48 seconds, and five times down, in 40 minutes, 26 seconds. Distance each journey, 2,002 yards. Total, 11.375 miles; distance passed over in the above time 1,663 yards each journey, or 9.45 miles; time, 1 hour, 26 minutes, 14 seconds; coals consumed, 587 lbs; water 200 gallons.

In this experiment the Engine was allowed to traverse a given space, to put the train of carriages into their proper velocity before the time was noted; the time was then marked until the velocity was again checked at the farther end of the stage. This will explain the difference between the two distances stated in the experiment; the one was the whole distance from the commencement to the end of the stage; the other was that part of the stage which the Engine passed over when the regular velocity was acquired, and before it was again diminished at the end of the stage, to stop the train; the time given was that which transpired while the Engine was passing over that space, while the velocity was uniform, and may therefore be taken as a measure of speed.

At page 281, Mr. Wood states, Upon a Rail Road, near Newcastle, a Locomotive Engine in fifty-four weeks conveyed 53,823 Carriages of coals, each weighing 9,438 lbs. 2,541 yards, and returned with the same number of empty Carriages, each weighing 3,472 lbs. This was in fifty-four successive weeks, and, in that time, exclusive of Sundays, the Engine, from want of goods to convey, was at least twenty days off work; so that in 304 days the performance was 446,815 tons conveyed one mile; or 1,470 tons one mile each day on a stage, only 2,541 yards. The Engine had three feet wheels, which were calculated for a rate of about $4\frac{1}{2}$ miles per hour.

Mr. Rastrick,

T A B L E.

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ENGINES.	RAIL ROADS.	I N S U M M E R.											
		At 5 Miles per Hour.				At 8 Miles per Hour.				At 10 Miles per Hour.			
		Goods.	Car- riages.	Engine and Tender.	Gross Weight.	Goods.	Car- riages.	Engine and Tender.	Gross Weight.	Goods.	Car- riages.	Engine and Tender.	Gross Weight.
		Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.
Engine on six 4 feet wheels, (Hackworth.)	Stockton and Darlington }	$47\frac{3}{4}$	$23\frac{3}{4}$	15	$86\frac{1}{2}$	26	18	15	54	$18\frac{3}{4}$	$9\frac{1}{2}$	15	$43\frac{1}{4}$
Engine on four 4 feet wheels - -	Stockton and Darlington }	$34\frac{2}{3}$	$17\frac{1}{3}$	12	64	$18\frac{2}{3}$	$9\frac{1}{3}$	12	40	$13\frac{1}{3}$	$6\frac{2}{3}$	12	32
Engine on four 4 feet 2 inch wheels -	Killingworth Colliery - }	38	19	$10\frac{1}{2}$	$67\frac{1}{2}$	21	$10\frac{1}{2}$	$10\frac{1}{2}$	42	$15\frac{1}{2}$	$7\frac{1}{2}$	$10\frac{1}{2}$	$33\frac{1}{2}$
Engine on four 3 feet wheels - -	Hetton Colliery	$24\frac{1}{4}$	12	$10\frac{1}{2}$	$46\frac{3}{4}$	$12\frac{1}{2}$	$6\frac{1}{4}$	$10\frac{1}{2}$	$29\frac{1}{4}$	$8\frac{3}{4}$	$4\frac{1}{4}$	$10\frac{1}{2}$	$23\frac{1}{2}$
Engine on four wheels, rack rail -	Middleton Colliery near Leeds - }	$22\frac{1}{4}$	11	$6\frac{1}{4}$	$39\frac{1}{2}$	$12\frac{1}{4}$	$6\frac{1}{4}$	$6\frac{1}{4}$	$24\frac{1}{4}$	9	$4\frac{1}{2}$	$6\frac{1}{4}$	$19\frac{1}{4}$

THE Engines started for the premium of £.500, on the *Liverpool and Manchester Railway*, in October 1829, were, the *Rocket*, *Novelty* and *Sans Pareil*.

The *Rocket* weighed - - - 4 5 - - } -- Full speed 30 miles in
Tender, with Water and Coke - - 3 4 - 2 } 2 h. 14 m. 8 s. equal to
Two Carriages loaded - - - 9 10 3 26 } $13\frac{4}{5}$ per hour; back,
17 - - - } 30 miles in 2 h. 6 m. 9 s.
equal to $14\frac{2}{5}$ per hour.

Sans Pareil - - weight of Engine - - 4 15 2 - } -- Full speed, $10\frac{1}{2}$ miles
Tender, with Water and Fuel - - 3 6 3 - } in 50 m. 49 s. equal to
Three Carriages - - - 10 19 3 - } $12\frac{4}{5}$ per hour; back,
19 2 - - } 12 miles in 40 m. 27 s.
equal to $15\frac{5}{8}$ per hour.

Novelty - - weight of Engine with }
Water in the Boiler - - - } 3 1 - - }
Tank, Water and Fuel - - - - 16 - 14 } -- Total time, 22 m. 57 s.
Two Carriages - - - - 6 17 - - } and distance run $4\frac{1}{2}$
10 14 - 14 } miles.

N. B.—The Railway was level, and about two miles in length, where the experiments were made.

QUERY 2.—What may be considered as the greatest performance of locomotive carriages previous to the Manchester and Liverpool Railway being opened?

Mr. Wood, in 1825, states that the performance of the best Locomotive Engine was equal to 40 tons, conveyed at the rate of six miles an hour; and four years after (in 1829), Messrs. Rastrick and Walker have stated, that $48\frac{1}{2}$ tons conveyed five miles an hour,

or

Mr. Rastrick, in his Report to the Directors of the Liverpool and Manchester Railway, dated January 1829, gives the following Table of the absolute quantity of work done by five different Locomotive Engines, when reduced all to the same standard of five, eight and ten miles per hour. The Carriages proportioned to the weight of goods, in the same ratio as they were proposed for the Liverpool and Manchester Railway, and also of the work that the ten-horse Engine, proposed by him and Mr. Walker, would be capable of doing.

T A B L E.

I N W I N T E R.

At 5 Miles per Hour.				At 8 Miles per Hour.				At 10 Miles per Hour.			
Goods.	Carriages.	Engine and Tender.	Gross Weight.	Goods.	Carriages.	Engine and Tender.	Gross Weight.	Goods.	Carriages.	Engine and Tender.	Gross Weight.
Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.
40 $\frac{3}{4}$	20 $\frac{1}{4}$	15	76	21 $\frac{3}{4}$	10 $\frac{3}{4}$	15	47 $\frac{3}{4}$	15 $\frac{3}{4}$	7 $\frac{3}{4}$	15	38
28 $\frac{3}{4}$	14 $\frac{1}{2}$	12	55 $\frac{1}{4}$	15	7 $\frac{1}{2}$	12	34 $\frac{1}{2}$	10 $\frac{4}{10}$	5 $\frac{3}{10}$	12	27 $\frac{6}{10}$
31 $\frac{1}{4}$	15 $\frac{3}{4}$	10 $\frac{1}{2}$	57 $\frac{1}{2}$	17	8 $\frac{1}{2}$	10 $\frac{1}{2}$	36	12	6 $\frac{1}{2}$	10 $\frac{1}{2}$	28 $\frac{1}{4}$
19 $\frac{3}{4}$	9 $\frac{3}{4}$	10 $\frac{1}{2}$	40	9 $\frac{3}{4}$	4 $\frac{3}{4}$	10 $\frac{1}{2}$	25	6 $\frac{1}{4}$	3 $\frac{1}{4}$	10 $\frac{1}{2}$	20
19 $\frac{1}{4}$	9 $\frac{1}{2}$	6 $\frac{1}{4}$	35	10 $\frac{1}{4}$	5 $\frac{1}{4}$	6 $\frac{1}{4}$	21 $\frac{1}{4}$	7 $\frac{1}{2}$	3 $\frac{3}{4}$	6 $\frac{1}{4}$	17 $\frac{1}{2}$

or 19 $\frac{1}{4}$ tons conveyed 10 miles an hour, was the greatest performance the Directors of the Liverpool Railway could expect from them.

I have seen some statements of experiments in which the effective work was greater than the above; but I am inclined to think, they could not be so well depended on as those of Messrs. Wood, Rastrick and Walker.

QUERY 3.—What has been the greatest performance of any Engine since that period?

On the 23d of February 1831, Mr. Robert Stephenson stated to the Society of Civil Engineers, that the Northumbrian Locomotive Engine, weighing 6 tons 3 cwt., drew 50 tons up the inclined plane at Rainhill, at the average rate of 7 $\frac{1}{2}$ miles per hour: pressure of Steam was 50lbs. on the square inch. The inclination of the ground at Rainhill is 1 in 96.

On the 1st of March 1831, Mr. Locke stated, that “The Samson” drew a gross weight of 151 tons in 30 waggons (the nett weight being 107 tons), the whole distance from Liverpool to Manchester, in 2 hours 34 minutes, including 13 minutes of stoppages. The diameter of the wheels was 4 feet 6 inches.

On the 19th of April 1831, Mr. Locke stated, that “The Samson” drew up the inclined plane at Rainhill about 44 $\frac{1}{2}$ tons gross of goods and waggons, at the rate of about eight miles an hour.

Weight of the Engine was 8 $\frac{1}{2}$ tons; weight of Tender (which was full of water), 4 tons; making the total weight of Goods, Waggons, Engine, and Tender, 57 tons; and, calculating the speed of the Engine eight miles per hour, she was exerting a force equal to 39 horse power.

He also stated, that a new Engine, “The Jupiter,” had just been started. From the 4th of March to 6th of April, she drew 226 Waggons (only 10 of which were empty) and 847 Coaches, a total distance of 3,426 miles. In one fortnight she made 50 journeys, equal to 1,500 miles.

Diameter of cylinder, 11 inches; length of stroke, 16 inches; diameter of the wheels, 5 feet. Value of such an Engine, £.700.

Mr. Haskins, in his Report to the Directors of the Liverpool and Manchester Rail-
way, dated January 1850, gives the following Table of the absolute quantity of work
done by five different locomotive engines, when reduced all to the same standard of
five eight and ten miles per hour. The Carriages proportioned to the weight of goods,
in the same ratio as they were proposed for the Liverpool and Manchester Railway, and
also of the work that the locomotives could do, by him and Mr. Walker, would be
capable of doing.

Appendix (B.)

PROPOSED SCALE for TURNPIKE TOLLS on STEAM CARRIAGES.

EVERY CARRIAGE propelled by STEAM, or other Elementary Power, carrying only Fuel and Engineers, and having the Tires of the Wheels less than 2 inches and a half, and,					BUT if the CARRIAGE draws or propels another,				
Weighting	Cwt.	and not exceed	Cwt.	a Toll as	One Horse not drawing	then as	One Horse drawing.		
—	5	10	20	—	Two	—	Two	—	
—	20	30	40	—	Three	—	Three	—	
—	30	40	50	—	Four	—	Four	—	
—	40	50	60	—	Five	—	Five	—	
—	50	60		—	Six	—	Six	—	

Above this weight an arbitrary Toll, preventing its exceeding it on narrow Wheels.

IF the Tires of the Wheels exceed Three Inches, the Tolls should be about one quarter less,
and the weight without injury, may extend to three tons and a half. If the Tires of the Wheels
are Six Inches wide, the Tolls should be about a third less, and the weight allowed to extend as
far as four or five Tons.

Appendix (C.)

RETURN of all TURNPIKE ROAD BILLS which passed The House of Commons in Session 1830/31, wherein any TOLL has been imposed on Carriages propelled by Steam or other Mechanical contrivance; distinguishing, the Amount of TOLL charged per Horse on Stage Carriages, Vans, Waggons and Cars, and the charge on Steam Carriages.

	STAGE COACHES, &c. per Horse.	WAGGONS, VANS, &c. according to the Breadth of the Wheels per Horse.	PROPELLED BY MACHINERY.	
			CARRIAGES With Two Wheels.	CARRIAGES with Four Wheels.
BEDFONT Road - -	6 d.	4 d. 5 d. 6 d.	{ 6 d. per wheel for all Carriages.	
Highgate and Whetstone Road.	6 d.	4 d. 5 d. 6 d.	- - 1 s. 6 d. - -	2 s. 6 d.
Norwich and Yarmouth Road.	6 d.	4 d. 6 d.	2 s. for all Carriages.	
Walsall Roads - -	4 ½ d.	4 ½ d. 6 d. 8 d.	2 s. 6 d. for all Carriages	
Stretford Road - -	6 d.	6 d. 7 ½ d. 9 d.	{ The same Toll as if drawn by four horses	
Tunbridge Wells and Maresfield Road.	4 d.	2 d. 3 d. 4 ½ d.	{ 1 s. per ton weight for all Carriages.	
Birmingham and Bromsgrove Road.	4 ½ d.	2 ½ d. 3 d. 4 ½ d.	{ - - For locomotive Engines drawing carriages, 2 s.; for Steam Carriages, for passengers, &c. 1 s. 6 d.	
Perry Barr and Handsworth Road.	4 ½ d.	4 ½ d. 6 d. 8 d.	2 s. 6 d. for all Carriages	
Enfield Chase Road -	4 d.	3 d. 4 ½ d. 6 d.	1 s. for all Carriages.	
Lemsford Mill Road -	7 ½ d.	6 d.	- - 1 s. 6 d. - -	2 s. 6 d.
Linlithgowshire Roads -	- For one horse 1 s. 6 d.; two horses, 2 s. three or four ditto, 4 s.	For 1 horse 6 d. 2 ditto 10 d. 3 ditto 3 s. 4 ditto 4 s. 5 ditto 6 s. 6 ditto 8 s.	{ - - One penny per cwt. for all Carriages.	
Coventry, and OverWhiteacre Road.	3 d.	2 d. 3 d. 4 d.	2 s. 6 d. for all Carriages	
Watling Street Road -	4 ½ d.	4 d. 5 d. 6 d.	2 s. 6 d. for all Carriages	
Pinwall Lane Road -	4 ½ d.	4 d. 5 d. 6 d.	2 s. 6 d. for all Carriages	
Worthing and Littlehampton Road.	6 d.	4 d. 5 d. 6 d.	{ 1 s. per wheel for all Carriages.	
Leeds and Birstal Road -	8 d.	6 d. 7 ½ d. 9 d.	{ 2 s. per wheel for all Carriages.	
Haslemere Road - -	4 ½ d.	4 ½ d.	- - 1 s. - -	2 s.
Macclesfield and Nether Tabley Road.	6 d.	6 d. 8 d.	{ 9 d. per wheel for all Carriages.	
Glamorganshire Roads -	6 d.	6 d.	- - 1 s. 6 d. - -	3 s.
Cleeve and Evesham Road -	9 d.	9 d.	- - 1 s. 6 d. - -	3 s.
Pucklechurch Roads -	6 d.	6 d. 7 ½ d. 9 d.	1 s. per cwt.	
Leicester and Welford Road.	4 ½ d.	3 d. 3 ½ d. 4 d.	1 s. for all Carriages.	
Lampeter Roads - -	6 d.	4 ½ d. 5 ½ d. 6 d.	{ The same Toll as if drawn by four horses.	
Llandovery and Llangadock Road.	6 d.	4 ½ d. 5 ½ d. 6 d.	{ The same Toll as if drawn by four horses.	
Bathgate Roads - -	1 s. 3 d.	{ - For one horse, 9 d. if more than one, 6 d. p' horse.	{ - - 2 s. 9 d. for all Carriages not exceeding 25 cwt.	
Titchfield and Cosham Road.	6 d.	3 d. 3 ¾ d. 4 ½ d.	{ 2 s. per wheel for all Carriages.	
Cheadle Roads - -	6 d.	4 d. 5 d. 9 d.	5 s. for all Carriages.	
Bruton Roads - -	6 d.	4 ½ d. 6 d. 7 ½ d. 9 d.	4 s. for all Carriages.	
Coventry and Stoney Stanton Road.	3 d.	4 d. 5 d. 6 d.	2 s. 6 d. for all Carriages.	
Liverpool and Preston Road.	6 d.	{ - - If drawn by 4 or 5 horses, 1 s., 1 s. 5 d. 2 s. 3 d., 2 s. 5 d. If by 2 or 3 horses, 4 d., 6 d., 8 d.	{ - - If not exceeding one ton, 6 d. p' wheel; and 6 d. p' wheel for every further ton weight.	

Appendix (D.)

RETURN of all PRIVATE BILLS which have passed The House of Commons wherein any TOLL has been imposed on Carriages propelled by Steam or other Mechanical Contrivance; distinguishing the Amount of TOLL charged per Horse on Stage Carriages, Vans, Waggon and Cars, and the Charge on Steam Carriages.

	STAGE COACHES, &c. per Horse.	WAGGONS, VANS, &c. according to the breadth of the Wheels.	PROPELLED BY MACHINERY.	
			CARRIAGES with Three or a less Number of Wheels.	CARRIAGES with Four or more Wheels.
KIDWELLY Roads	6 d.	4 d. 5 d. 6 d.	2 s. for two-wheeled Carriages	3 s.
Lynn (East Gate) Road	4 d.	3 d. 3½ d. 4½ d.	2 s. 6 d. for all Carriages.	
Lynn (South Gate) Road	4 d.	3 d. 3½ d. 4½ d.	2 s. 6 d. for all Carriages.	
Handsworth Road	6 d.	6 d. 8 d. 9 d.	The same Toll as if drawn by four horses.	
Aylsham Road	3 d.	2 d.	9 d.	1 s. 6 d.
Cheltenham Roads	8 d.		3 s. for all Carriages.	
Liverpool and Prescott Road.	1 s. 6 d. & 1 s.	6 d. 8 d. 10 d. 1 s.	1 s. 6 d. for every horse power for all Carriages.	
Abergavenny Roads	6 d.	8 d. 9 d. 1 s.	The same Toll as if drawn by four horses.	
Drogheda Roads	6 d.	2 d. 4 d. 6 d. 1 s.	The same Toll as if drawn by two horses.	
St. Alban's Road	6 d.		1 s. 6 d.	2 s. 6 d.
Sunderland Roads	4½ d.	3 d. 4 d. 9 d. 1 s.	6 d. for every horse power for all Car- riages.	
Wisbech and Thorney Road.	6 d.	3 d. 3½ d. 4½ d.	2 s.	4 s.
Frome Roads	6 d.	6 d. 7 d. 8 d.	2 s. for all Carriages.	
Huddersfield and Wood- head Road.	6 d.	3 d. 4 d. 4½ d.	2 s. 6 d. for all Carriages.	
Wakefield and Auster- lands Road.	6 d.	4 d. 5 d. 6 d.	2 s. 6 d. for all Carriages.	
Monmouth Roads	8 d.	5 d. 6 d. 7 d. 1 s.	1 s. 6 d.	2 s. 6 d.
Wakefield Ings Road	3 d.	1 d. 1½ d. 2 d.	6 d.	1 s.
Stirlingshire Roads	1 s. 3 d.	- - If not ex- ceeding 25 cwt. 9 d. If between 25 & 30 cwt. 1 d. in addition, and so in pro- portion - -	- - 2 s. 6 d. for every Carriage not exceeding 25 cwt. If between 25 & 30 cwt. 1 d. per cwt. in addition, and so in proportion.	
Exeter Roads	8 d. 9 d.	- - If drawn by one horse only, 9 d.; if by two or more horses, 6 d. per horse.	- - If not exceeding 1 ton, 6 d. per wheel. If more than 1 ton, 6 d. per wheel in addition, and 6 d. per wheel for every further ton weight.	
Teignmouth and Dawlish Road.	- - If drawn by two or three horses, 8 d.; if by four or more horses, 6 d. -	9 d.	- - If not exceeding 1 ton, 6 d. per wheel. If more than 1 ton, 6 d. per wheel in addi- tion, and 6 d. per wheel for every further ton weight.	
Darlington Road	- - If drawn by two or one horse 10 d.; if by four horses, 8 d. and if by six horses, 6 d. per horse -	6 d. 8 d. 10 d.	1 s.	2 s.

Private Bill Office,
House of Commons,
August 22, 1831.

Edward Johnson.

Appendix (E.)

SCALE for fixing TOLLS on the various kinds of STEAM CARRIAGES equivalent to HORSE COACHES, calculated on the comparative Wear and Tear of Roads.

[Given in to the Committee by Mr. Gurney.]

THE following SCALE of Proportions is taken from a Trust where the Tolls fixed are Three Pence for every Horse *drawing*, and One Penny *not drawing*; and may be applied to determine the Tolls on any other Trust, where the Tolls are fixed at a Higher or Lower Rate:—

EVERY STEAM CARRIAGE with the Tires of the Wheels under Two Inches and a half, and

Cwt.		Cwt.		s. d.	d.		
Weighing - 5	but not exceeding	10	shall pay a Toll of	- 3	{when draw- ing one Car- riage only -	{not draw- ing any Carriage -}	1
- 10	- - - -	20	- - - -	- 6	- - - -	- - - -	2
- 20	- - - -	30	- - - -	- 9	- - - -	- - - -	3
- 30	- - - -	40	- - - -	1 -	- - - -	- - - -	4
- 40	- - - -	50	- - - -	1 3	- - - -	- - - -	5
- 50	- - - -	60	- - - -	1 6	- - - -	- - - -	6
- above 60	for every extra hundred weight	-	- - - -	- 3	- - - -	- - - -	1

EVERY STEAM CARRIAGE with the Tires of the Wheels not less than Four Inches, and

Cwt.		Cwt.		s. d.	d.
Weighing - 10	but not exceeding	20	shall pay a Toll of	- 4	{when draw- ing one Car- riage only - } not drawing 1
- 20	- - - -	30	- - - -	- 6	- - - - 1½
- 30	- - - -	40	- - - -	- 8	- - - - 2
- 40	- - - -	50	- - - -	- 10	- - - - 3
- 50	- - - -	60	- - - -	1 -	- - - - 4
- 60	- - - -	70	- - - -	1 2	- - - - 4½
- above 70	for every extra hundred weight	-	- - - -	- 2	- - - - ½

EVERY STEAM CARRIAGE with the Tires of the Wheels not less than Six Inches, and

Cwt.		Cwt.		s. d.	d.	
Weighing - 20	but not exceeding	30	shall pay a Toll of	- 3	when draw- ing one Car- riage only - not drawing 1	
- 30	- - - -	40	- - - -	- 5	- - - -	1½
- 40	- - - -	50	- - - -	- 7	- - - -	2
- 50	- - - -	60	- - - -	- 9	- - - -	2½
- 60	- - - -	70	- - - -	- 11	- - - -	3
- 70	- - - -	80	- - - -	1 1	- - - -	3½
- above 80	for every extra hundred weight	-	- - - -	- 1½	- - - -	-½

N.B.—The Carriage and Load drawn by the Steam Carriage, shall not exceed double the Weight of the Drawing Carriage.

Appendix (F.)

EXTRACTS from SEVENTH REPORT of the HOLYHEAD ROAD COMMISSIONERS; showing the Number of Lbs. required to draw a Waggon of the weight of 21 cwt. 8 lbs. at the rate of $2\frac{1}{2}$ Miles per Hour.

1.	2.	3.	4.	5.	6.	7.
PARTS On which the EXPERIMENTS were Tried.	Number of Observations.	Rate of Inclination.	Actual Draught in Lbs., or propor- tional Number of Horses required on each Station.	Correction for the Rate of Inclination.	Draught reduced, or the proportional Number of Horses that would be re- quired if the Road was horizontal.	OBSERVATIONS.
All the EXPERIMENTS were made in the middle of the month of March 1830, during dry weather.						
No. 1.—PICCADILLY PAVEMENT:						
From Stratton-street to Devon- shire House.	15	rise, 1 in 114	60 $\frac{1}{2}$	20 $\frac{1}{2}$	40	Excellent, smooth, well laid pavement.
Devonshire House to Dover- street.	14	rise, 1 in 156	48 $\frac{1}{4}$	15 $\frac{1}{4}$	33	- ditto - - - ditto.
Dover-street to James-street -	13	fall, 1 in 429	42 $\frac{1}{4}$	5 $\frac{3}{4}$	48	} - - Pavement uneven and worked into holes, the top of the stones a good deal rounded, and the joints opened.
St. James-street to Bond-street -	8	rise, 1 in 245	54	9	45	
Bond-street to Burlington Arcade	11	fall, 1 in 286	40	8 $\frac{1}{4}$	48 $\frac{1}{4}$	
Burlington Arcade to Albany- court.	20	horizontal -	41 $\frac{3}{4}$	- -	41 $\frac{3}{4}$	
No. 2.—ARCHWAY ROAD:						
Between tollbar and new house on the right.	32	rise, 1 in 23 -	173	102 $\frac{1}{2}$	70 $\frac{1}{2}$	} - - This road lately repaired by putting on a cemented foundation, and covering the fifteen middle feet with broken Guernsey granite, six inches in thickness.
Between new house and Depot No. 1.	13	rise, 1 in 23 -	163	102 $\frac{1}{2}$	60 $\frac{1}{2}$	
Between Depot No. 1, and Arch- way.	64	rise, 1 in 22 -	171	108	63	
Between Archway and lamp No. 11	31	rise, 1 in 49 -	115	48	67	} - - The surface not perfectly consolidated, and shaded with trees.
Between eleventh and twelfth lamp posts.	13	rise, 1 in 229	78	10 $\frac{1}{4}$	67 $\frac{3}{4}$	
Between twelfth and thirteenth lamp posts.	12	horizontal -	47	- -	47	
Between thirteenth and fifteenth lamp posts.	26	fall, 1 in 382	46	6 $\frac{1}{4}$	52 $\frac{1}{4}$	
Between nineteenth and twenty- first lamp posts.	35	rise, 1 in 27 -	151	87	64	
Between twenty-first and twenty- second lamp posts.	22	rise, 1 in 27 -	152	87	65	
Between twenty-second lamp post and M'Pherson's.	16	rise, 1 in 3,437	59	- $\frac{1}{2}$	58 $\frac{1}{2}$	
Between Wellington-inn and Whetstone-road.	20	horizontal -	44	- -	44	
No. 3.—HOCKLIFFE and STRATFORD TRUST:						
Near Fountain inn, Shenley -	49	horizontal -	97	- -	97	12 inches of limestone; low fences.
Near Talbot inn, north of Shenley	36	rise, 1 in 20 $\frac{1}{2}$	232	115	117	- - - ditto - good foundation, firm and dry, not worked in.
Flat, north side of Shenley -	34	fall, 1 in 119	93	19 $\frac{3}{4}$	112 $\frac{3}{4}$	12 inches limestone; plantation south side.
Ditto, near Speckland Hollow -	77	horizontal -	120	- -	120	- - 11 inches pebble and limestone; planta- tion south side.
Crown Hill - - - -	38	rise, 1 in 45 -	128	52 $\frac{1}{2}$	75 $\frac{1}{2}$	} - - Embankment; paved foundation, covered with 10 inches of broken limestone.
Ditto, near summit - -	26	rise, 1 in 27 -	136	87	49	
Between Crown Hill and the toll- bar.	56	rise, 1 in 66 -	115	35 $\frac{3}{4}$	79 $\frac{1}{4}$	12 inches limestone; no sub-pavement.
Flat between Two-mile Ash and Stony Stratford - - -	68	rise, 1 in 3,437	60	1	59	18 inches limestone; low fences, no trees.
Near same place, tried back -	58	fall, 1 in 3,437	57	1	58	- - - ditto - - - ditto.

Appendix (F.)—continued.

1.	2.	3.	4.	5.	6.	7.
PARTS						OBSERVATIONS.
On which the EXPERIMENTS were Tried.	Number of Observations.	Rate of Inclination.	Actual Draught in Lbs., or proportional Number of Horses required on each Station.	Correction for the Rate of Inclination.	Draught reduced, or the proportional Number of Horses that would be required if the Road was horizontal.	
No. 4.—STRATFORD and DUNCHURCH TRUST:						
Flat between 65th mile-stone and brick house.	23	rise, 1 in 20 -	270	118	152	-- 6 inches limestone, low fences each side, trees and high bank on west.
Between brick house and road to Northampton.	7	rise, 1 in 21 -	292	112	180	-- 5 ½ inches limestone, high hedges and bank on south-west.
Over small embankment above brickhouse.	22	rise, 1 in 22 ¾	343	103	240	-- 6 inches limestone, high hedges, new stone, on a week.
Between sand pits and road to Stowe.	23	rise, 1 in 39 -	128	60 ½	67 ½	6 inches limestone, open and low fences.
Between road to Stowe and the Angel inn.	37	rise, 1 in 71 ½	95	33	62	-- 5 inches limestone, open wide space between, low fences.
Between hollow and 66th mile-stone.	70	rise, 1 in 31 -	130	76	54	-- 3 ½ inches of Hartshill, and 2 inches of limestone, on pitching.
Between 66th mile-stone and summit of hill.	80	rise, 1 in 26 -	145	91	54	-- 3 inches ditto - ditto, over embankment.
Rising next hill - - -	60	rise, 1 in 50 -	90	47	43	5 inches ditto - ditto, through cutting.

EXTRACT from Mr. Telford's REPORT on the State of the HOLYHEAD and LIVERPOOL ROADS.

BEING authorized by the Commissioners to have the Machine invented by my assistant, Mr. Macneill, (for measuring the force of traction, or the labour of horses in drawing carriages) completed, and also to have the several Districts of the Holyhead Road in England tried by it; Mr. Macneill has done so, and prepared a Statement, showing the results of the trials between London and Shrewsbury, a distance of 153 ¼ Mi e3.

The general Results of these Experiments* on different sorts of Roads, are as follows:

- 1.—On well-made pavement, the draught is - - - - 33 lbs.
- 2.—On a broken stone surface on old flint Road - - - - 65 —
- 3.—On a gravel Road - - - - - 147 —
- 4.—On a broken stone Road, upon a rough pavement foundation - - 46 —
- 5.—On a broken stone surface upon a bottoming of concrete, formed of Parker's cement and gravel - - - - 46 —

The general Results of Experiments made with a Stage-coach †, on the same piece of Road, on different Inclinations and at different Rates of Velocity, are given, from which

The following STATEMENT has been calculated:—

Rate of Inclination.	Rates of Travelling.	Force Required.
1 in 20	6 miles per hour.	268 lbs.
1 in 26	6 —	213 —
1 in 30	6 —	165 —
1 in 40	6 —	160 —
1 in 600	6 —	111 —
1 in 20	8 —	296 —
1 in 26	8 —	219 —
1 in 30	8 —	196 —
1 in 40	8 —	166 —
1 in 600	8 —	120 —
1 in 20	10 —	318 —
1 in 26	10 —	225 —
1 in 30	10 —	200 —
1 in 40	10 —	172 —
1 in 600	10 —	128 —

* In making these Experiments, a Waggon, weighing about 21 cwt., was used.

† Weight of Coach, exclusive of Seven Passengers, 18 cwt.

Having the results of these accurate trials to refer to, leaves it no longer a matter of conjecture in what manner a Road should be made, to accomplish most effectually the main object, that is, diminishing to the greatest possible degree, the labour of Horses in draught.

Although the observations of scientific persons have led to nearly similar conclusions, others have been in the habit of laying down rules for Road-making at variance with all the established laws of motion; it is satisfactory to be able to produce a positive Proof by actual Experiment, of their opinions being wholly erroneous.

In this view, I consider Mr. Macneill's Invention for practical purposes on a large scale, one of the most valuable that has been lately given to the Public.

On which the Experiments were tried.		No. of trials.		Time of trial.		Distance of trial.		Remarks.	
1. Between 8th mile-stone and brick house.		23		1 in 20		118		Low limestone, low fences each side, trees and high bank on west.	
2. Between brick house and road to Northampton.		7		1 in 21		112		Low limestone, high hedges and bank on north-west.	
3. Over small embankment above brickhouse.		22		1 in 22 1/2		103		Low limestone, high hedges, new slope, on a week.	
4. Between road pits and road to Stone.		23		1 in 30		128		Low limestone, open and low fences.	
5. Between road to Stone and the Angel inn.		37		1 in 71 1/2		82		Low limestone, open wide space between, low fences.	
6. Between hollow and 6th mile-stone.		70		1 in 21		130		Low limestone, on pitching.	
7. Between 6th mile-stone and summit of hill.		80		1 in 26		112		Low limestone, ditto, over embankment.	
8. Between summit of hill and rising next hill.		60		1 in 20		90		Low limestone, ditto, through cutting.	

EXTRACT from Mr. Telford's Report on the State of the HORTHROP and LIVERPOOL ROADS.

Being authorized by the Commissioners to have the Machine invented by my assistant, Mr. Macneill, for measuring the force of traction, or the labour of horses in drawing carriages, completed, and also to have the several Districts of the Horthrop Road in England tried by it; Mr. Macneill has done so, and prepared a Statement, showing the results of the trials between London and Shrewsbury, a distance of 133 1/2 miles.

The general Results of these Experiments, on different sorts of Roads, are as follows:

1.—On well-made pavement, the draught is	23 lbs.
2.—On a broken stone surface on old hard Road	66 —
3.—On a gravel Road	147 —
4.—On a broken stone Road, upon a rough pavement foundation	46 —
5.—On a broken stone surface upon a beddening of concrete, formed of Parker's cement and gravel	46 —

The general Results of Experiments made with a Stage-coach, on the same piece of Road, on different inclinations and at different rates of Velocity, are given, from which

The following STATEMENT has been calculated:

Rate of inclination.		Force required.	
1 in 20	6 miles per hour.	208 lbs.	
1 in 20	4 miles per hour.	213 —	
1 in 30	6 miles per hour.	195 —	
1 in 40	6 miles per hour.	180 —	
1 in 50	6 miles per hour.	161 —	
1 in 60	6 miles per hour.	150 —	
1 in 70	6 miles per hour.	138 —	
1 in 80	6 miles per hour.	127 —	
1 in 90	6 miles per hour.	116 —	
1 in 100	6 miles per hour.	105 —	
1 in 110	6 miles per hour.	94 —	
1 in 120	6 miles per hour.	83 —	
1 in 130	6 miles per hour.	72 —	
1 in 140	6 miles per hour.	61 —	
1 in 150	6 miles per hour.	50 —	
1 in 160	6 miles per hour.	39 —	
1 in 170	6 miles per hour.	28 —	
1 in 180	6 miles per hour.	17 —	
1 in 190	6 miles per hour.	6 —	

* In making these Experiments, a Stage-coach, weighing about 21 cwt., was used.

R E P O R T

FROM

SELECT COMMITTEE

ON

MR. GOLDSWORTHY GURNEY'S CASE;

WITH

THE MINUTES OF EVIDENCE.

Ordered, by The House of Commons, to be Printed,

17 July 1834.

Veneris, 4^o die Julii, 1834.

Ordered,

THAT a Select Committee be appointed to inquire into the Case of Mr. *Goldsworthy Gurney*, as set forth in his Petition to The House, and to Report their Opinion thereupon:—And a Committee is appointed of—

Sir William Molesworth.

Mr. Hall Dare.

Mr. Jephson.

Mr. Bulteel.

Mr. Thornhill Baring.

Mr. Benett.

Mr. Robert Gordon.

Mr. Peter.

Earl of Darlington.

Sir Henry Hardinge.

Lord Viscount Sandon.

Sir George Cayley.

Mr. Cayley.

Mr. Blamire.

Mr. Pendarves.

Mr. Robert Wallace.

Sir Charles Lemon.

Captain Byng.

Mr. Miles.

Sir William Trelawney.

Mr. Handley.

Mr. Charles Buller.

Ordered, That the said Committee have power to send for persons, papers and records.

Ordered, That Five be the Quorum of the said Committee.

Jovis, 17^o die Julii, 1834.

Ordered, That the Committee have Power to report the Minutes of the Evidence taken before them.

R E P O R T.

THE SELECT COMMITTEE appointed to inquire into the case of Mr. *Goldsworthy Gurney*, as set forth in his Petition to The House, and to report their Opinion thereupon; and who were empowered to report the MINUTES of EVIDENCE taken before them :—HAVE agreed to the following REPORT:

YOUR COMMITTEE are only prepared, at the present late period of the Session, to report the Minutes of the Evidence taken before them; but they earnestly recommend that the inquiry may be resumed early in the next Session.

17 *July* 1834.

LIST OF WITNESSES.

Lunæ, 7 ^o die Julii, 1834.			Jovis, 10 ^o die Julii, 1834.		
Mr. Goldsworthy Gurney	-	p. 5	John Ward, Esq.	-	p. 47
			Mr. Thomas Bailey	-	51
			Mr. David Dady	-	54
			Alexander Gordon, Esq.	-	55
Martis, 8 ^o die Julii, 1834.			Veneris, 11 ^o die Julii, 1834.		
Mr. Goldsworthy Gurney	-	19, 24	Charles A. Thiselton, Esq.	-	60
Henry Handley, Esq. M. P.	-	23	Michael Farraday, D. C. L.	-	61
			Rev. Dionysius Lardner, LL. D.	-	62
Mercurii, 9 ^o die Julii, 1834.			John M'Neil, Esq.	-	68
Mr. Goldsworthy Gurney	-	28, 46	Mr. David Dady	-	79
Mr. David Dady	-	33	Alexander Gordon, Esq.	-	81
Mr. Samuel Gurney	-	36			
Mr. William Bulnois	-	38			
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			Mr. William Poole	-	88

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MINUTES OF EVIDENCE.

Lundæ, 7^o die Julii, 1834.

SIR WILLIAM MOLESWORTH, BARONET,
IN THE CHAIR.

Mr. Goldsworthy Gurney, called in; and Examined.

1. **I**S this your Petition?—[*a Paper being shown to the Witness*—It is.

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2. Have you turned your attention to locomotion by steam on common roads?—From 1824 to 1831 I was exclusively devoted to it; my first attention was turned to the subject when a boy; I was on a visit from school at Mr. Vivian's at Camborne; commonly known by the name of Captain Andrew Vivian; I went to school with Mr. Vivian's son at Truro, and often spent my holidays at Camborne, and it was here that I saw Trevithick's first experiment, with a view to drawing carriages by steam; he had an idea that it was practicable, and with that view built a carriage for the purpose; he tried it, however, on the common road, but could not make it start on the level; he then took it to a declivity, with a view of getting it to move; the carriage went down the declivity by its own gravitation, and got into a hollow at the bottom, towards Lord Dunstanville's leading from Camborne; a spot well remembered by me. I mention this circumstance here, to show that from that period the subject was with me a favourite one.

When at the bottom of the hill, he attempted to start the carriage again, but to my perfect recollection, the wheels went round upon the ground, but the carriage did not advance.

This fact made a strong impression on me, and naturally I never forgot it in after life. I came to London in 1821, and was appointed chemical lecturer at one of our institutions; here, during some experiments upon heat, I found that some of the received notions of heat as applied to raising steam, were incorrect. The extent of surface laid down as necessary in boilers for receiving heat sufficient to generate steam for a certain power, was overrated, and that it depended more on the nature than the extent of surface to effect given quantities; from several experiments it appeared, that if a certain state of surface could be produced, and a certain state of intensity of fire at the same time preserved, I should obtain a light and powerful boiler, which might be applied to locomotion with great economy and national advantage upon a common road. It was found that heating surfaces passed free heat through them with a facility in an inverse proportion to the thickness; at the same time it was observed that heat was given out by combustion by intensity in some rate or proportion with the quantity of oxygen given to it in a given time. These two facts, it will be seen, enabled me to construct a generator with much smaller surface than those hitherto used, for the purpose of raising a given quantity of steam, which would so reduce the weight, as to render it capable of propelling carriages on common roads, if a fulcrum could be contrived for the purpose. The difficulty remained as to the formation of an apparatus, in which advantage might be taken of these facts, so as to form a practicable boiler; I succeeded after some time in doing this: I consulted several engineers and eminent men

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of the day on the subject. They all stated that the insurmountable difficulty of propelling carriages on common roads, was not in the engine, but was in the means of applying it to the road.

3. Can you name those engineers whom you consulted?—I may mention, Sir Humphrey Davy, although not an engineer, was supposed to know what had been done in most subjects of mechanical science; Mr. Moyle, a celebrated engineer in Cornwall, who made the next experiment after Trevithick, of which I will personally detail the particulars to the Committee, and several other eminent men.

4. What was the difficulty that they stated?—That the wheel would turn round, and that the carriage would not advance. In consequence of this opinion, and the strong impression upon my mind, from the fact that I stated having seen when at school at Camborne, of the wheel going round; I did not feel it worth while to make a single experiment, but took it for granted that it was true; I took out a patent in 1825 for propelling carriages along common roads, in which patent, feet were proposed to be used; this patent is dated in May 1825; I soon found, however, from experiment, that the phenomenon of the wheels going round in all cases in which it had been observed, was a matter of accident; a peculiarity arises from the manner of letting the steam to the engine, explained in my former evidence in 1831; and that the wheel was sufficient, not only to propel the weight resting upon it, but also six times the weight that did rest upon it when properly managed.

5. Had it generally been believed that the friction had not been sufficient?—It was generally believed, and received, not only in this country, but in others, which are said to have better mathematicians amongst them; I believed it on account of having actually seen the fact at Mr. Trevithick's experiment. Mr. Moyle stated that he made an experiment in Cornwall, upon propelling carriages by pushing out poles at an angle of 45 degrees behind the carriage, and by that means thrusting it along, so convinced was he from what he had seen and heard.

6. Do you know of any other experiments which were tried to overcome the supposed difficulty?—I tried several; I have heard of many.

7. What were they?—At one time I used a revolving chain, which carried the rollers with it; they passed under the carriage to the ground, by which the carriage was propelled. Those rollers were armed with projections, so that, as they revolved under the carriage, they became stationary upon the ground; the engine acted on them, and propelled the carriage along; somewhat analogous to the ordinary method of rolling or launching a boat.

8. How did you find out that there was sufficient friction between the ground and the wheel of the carriage?—By experiment. In a very scientific publication now before me, it is stated to be "somewhat singular that a person of Mr. Gurney's quickness should have that opinion;" but when I state that I saw this fact when a boy, and that it was confirmed by the authority of engineers and practical men whom I highly respected, perhaps it is not to be so much wondered at that I believed it; knowing at the time enough of experiment to feel that the best theories are often upset when carried into practice.

9. When was it you found that there was sufficient friction?—About three or four months after I had taken out my patent I found this was an error. I will explain the circumstances which gave rise to this error in mechanical opinion, because I think it important in the history of the invention.

The steam in the ordinary stationary engines is thrown full upon the cylinder by large openings, and by that means it acts suddenly upon the piston of the engine; this by the laws of percussion, strikes or starts the wheel round before sufficient bite is obtained to move the carriage; but if the steam be slowly let on, then sufficient hold is obtained and the carriage will advance. It is evident that the fact, of Mr. Trevithick's wheel going round, arose from his steam being turned on in the ordinary or usual way then used in working steam engines, for it may be stated, that although the carriage was so heavy as not to be of any practical value, being nearly a ton weight to the horse power, yet still by decomposing time into power, either by means of the plane—the lever—or any mechanical mode of that description, he might have moved it on the road, although he could not have obtained any speed.

10. What did you do after you had discovered that there was sufficient friction?—I took out another patent.

11. In

11. In what year was that?—In 1825, about two or three months afterwards. The first experiment that I made with a steam carriage on the common road was with a model at Kilburn, in May 1823; the model with the propellers ascended the hill that was then not cut down, at the turnpike-gate at Kilburn. I built a full-size carriage in 1825; this carriage ascended Windmill-hill, near Edgware, and in the ascent of this hill I first discovered that the propellers did not come into use. I would refer the Committee to the Evidence in 1831, in which the peculiar facts are fully stated. My attention was then directed to the application to the wheels, with a view of producing a better and more effectual locomotive carriage. A continuation of these experiments went on favourably from point to point towards perfection.

12-13. That was in the year 1825?—By this time 1826.

14. Then the success of your experiments induced you to establish a manufactory?—Yes; I first established a workshop in Oxford-street, in which I built a carriage, the large full-sized carriage I spoke of; this was in the early part of 1826. But when I had tried the experiment in Kilburn, and discovered the error that I had been labouring under in regard to the wheels, and having taken out a new patent for the boiler, and seeing that I had overcome the chief difficulty in regard to weight, I moved into larger premises. Being confident in the great value of my patent, I took very large premises in the Regent's Park, being quite satisfied as to the ulterior result of the subject, at the same time having obtained such data as I conceived to be decisive upon the subject respecting weight, and the comparative expense of moving steam carriages in comparison with horse power, the injury upon the roads, and other important points. In these premises the experiments went on for some time, principally with a view of applying the various apparatus in the best possible way to working the wheels, which were now discovered to be effectual; at last I overcame most of the practical difficulties, and went up the old Highgate-hill, as a trial and proof of certain points.

15. When was that?—I think it was in the latter end of May 1826, or the beginning of April. At that time the opinion was very general that carriages could not move at all on common roads, and every one believed that they could not move up hill. The fact, however, being proved by this experiment, induced parties who were acquainted with it, to purchase a part of the patent; I was paid 5,000 *l.* for a sixth of the patent.

16. Have you any document to show that?—Yes, I have, which I will produce presently; before doing which, I beg to state in continuation, in my examination in 1831, I gave in as evidence a series of drawings, and also a description of the boiler. I should observe, the great difficulty was that of getting a sufficiently small and light boiler, or surface, to supply a sufficient quantity of steam. The most simple form was that of tubes. Tubes had been tried before for raising steam, but had invariably failed.

17. What was the cause of failure?—In consequence of the steam formed in the tubes driving out the water as it escaped.

18. Did you make a series of experiments to endeavour to overcome that difficulty?—I did; I made a series of experiments to ascertain the peculiar changes that took place in water under certain increase of temperature, increase of pressure, formation of steam, and the compressing of it; and also when escaping from the vessel.

19. What was the result of those experiments?—The result of those experiments was, first, the observation that a circulation in the vessel took place in virtue of the change of specific gravity occasioned by the heat passing to the fluid, in a rapidity proportioned to the intensity of heat.

20. What do you mean by circulation?—The particles of water which are in contact with the heated surface, become specifically lighter and ascend; they are succeeded by colder portions that descend in virtue of greater specific gravity. I beg further to observe, that when particles of water are converted into steam they rise so very rapidly that they carry a large portion of water with them, which, in a vessel sufficiently large, are returned through a current setting down in some part of the same vessel: there is an exceedingly rapid circulation of ascending steam and descending water when under strong heat. The steam remains on the upper surface, and the water falls to the bottom. The reason why water is driven out of tubes is, that the particles of water

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being mixed and mechanically driven with the steam, become a part of the current, and invariably pass off with it when allowed to escape.

21. You say the water came out of the tubes, what do you mean by that?—That if a tube is used, the area of which is not sufficient for the return current of water to pass the ascending current, then both currents become ascending, and the water in consequence is driven out.

22. And it was found that in boilers with tubes the water went out altogether?—In every case where they had been used as far as I know; engineers had not provided for this natural consequence, and the water, as the steam became formed, was always driven out; no means being provided for its return. It is evident, if it had attempted to return through the same pipe, the heat which raised the steam to first drive it out, would accumulate in the pipe, so that it would have formed the water into steam instantly, and thus would prevent its return; therefore, to attempt to use tubes in the ordinary way was out of the question; the tubes would burn out as a matter of course after the water was driven off, and no steam could be formed.

23. How did you propose to overcome that difficulty?—The plan I adopted to overcome the difficulty was, to pass the water back again through a separate vessel, which made a distinct descending current away from the heating surface. Previous to entering which, I should observe, it was also carried into a separate or distinct vessel provided for the purpose of separation, as shown in these drawings, which I will explain. The steam being separated from the water (B), remains on the surface, and out of the influence of the heat at (A); the water being separated, descends through the separate current (C), and supplies the place of the ascending portion of the current that was driven along by the steam. By these means the difficulty of keeping water when it was under any pressure, or submitted to any extent of heat in tubes, was overcome; the separate vessel (A) which I call a separator, was highly essential, inasmuch as it effected a complete separation of steam and water, which had previously taken place in the ascending current, and enabled the steam to be drawn off dry for the engines: without a separator, but with the returning channel, water would pass mechanically to the engines, and the boilers be comparatively imperfect.

24. Then the two principles of your boilers were, the separator and the principle of circulation?—The circulation and separation, in distinct vessels, are the great points. I was obliged to make two distinct vessels; I was obliged to employ tubes in consequence of their becoming necessary to reduce the size or weight of the generator or boiler for the purposes of effecting locomotion.

25. Was this separating portion as essential as the circulator?—Almost as necessary.

26.—What do you conceive peculiar to your own boilers?—The mode of separation and circulation through distinct channels or vessels.

27. Was that the principle for which you took out your patent?—Yes, the second patent.

28. Had the difficulty which you have stated arising from the use of tube boilers, when the ascending current of steam was so elastic that it carried forward the quantity of water, been remedied, or been attempted to be remedied, previously to your adding a separator to your boiler?—Decidedly not. I should observe, in connexion with that question, that when Mr. Wolfe, who succeeded Mr. Trevithick, in attempting to use tubes for his double power engine of high pressure and low pressure combined, reduced his cylinders below six inches in diameter, that he found the water would not remain in them: this was evidently arising from the want of room for the ascending and descending currents.

29. Who was the first person who introduced the use of tubes in place of boilers as boilers?—They have been tried repeatedly; Trevithick, Bolton & Watt, Dr. Robinson and others. Tubes have been attempted to be used for the last fifty years; perhaps as long as the steam engine has been in use; but they were never used with success. They were invariably found to burn out; Mr. Perkins, to overcome this natural difficulty of the water leaving the tube, proposed to keep it in by immense mechanical pressure, so great, that no particle of water should leave one end of the tube until a particle of water had entered at the other end, urged by a strong hydraulic press.

30. What was the result of that attempt?—The result was the working of a steam engine for some time, but I believe it has never been carried into extensive practice.

31. Do

31. Do you know of any boilers that, in consequence of becoming red-hot, blow up by forming elastic gas, under those circumstances in the mode of using the tube before your invention?—I recollect Mr. Wolfe stating to me that it very often happened that the tube, or rather cylinders which he used, produced a strong percussion, which broke all the joints of the boiler; no doubt, by some mechanical cause, a portion of the water left the surface, which becoming hot occasioned this effect. The cause seems to be the sudden formation of steam upon hot surfaces. I should observe, that another difficulty, and a very serious one in practice, that Wolfe found when he used cylinders (those vessels of this form, properly so called, are six inches in diameter), was, that after a time they became filled with earthy deposit.

32. What was the size of the tubes which were used in your boilers?—About an inch.

33. And inch tubes have always been found to burn out?—No; but I do not exactly understand the question.

34. What is the smallest size of tubes that were used in other boilers, but which were not found to burn out?—Six inches.

35. What was the thickness of the metals?—Of about three-fourths to seven-eighths.

36. You stated that earthy deposits were found in the tubes; how did that affect it?—When the earthy deposit collects in a cylinder of six inches in diameter, it reduces the area of it; the consequence of which is, that the circulation then becomes defective for want of room, the tube then burns out; this effect produced from earthy deposits forming in large quantities in tubes, induced Mr. Wolfe to have some mechanical mode for getting it out, which he did, by taking off the ends of the cylinders.

37. Have you found that there are earthy deposits in larger tubes?—Yes.

38. What was the effect of their being there?—The evil effects of deposit in tubes, is first to occasion a non-conducting stratum between the heated surface and the water, which of course prevents the heat passing from the fire, and consequently occasions the tubes to become red-hot and burn out.

39. How did you obviate that difficulty?—The difficulty, in the first instance I attempted to obviate by a chemical solution of the deposit; but I found, in practice, that operatives were not always philosophers; they neglected to do it, and I generally found that the boilers were subject to the injury of the fire; consequently I was obliged to devise a mode of cleaning them by mechanical means.

40. Will you state that mechanical contrivance?—A cap is screwed over the cross-end of the tube; then a rod, armed with a screw or projecting feathers, is driven up and down, till the whole of the deposit is taken off.

41. What do you mean by feathers?—Projections similar to those of the feathers on an arrow, or like the rod commonly used for cleaning guns.

42. This was the same principle as Mr. Wolfe's?—No; there was no means provided for cleaning the previous tube boilers attempted to be used by engineers, for the best of all reasons; namely, they never continued to use a boiler long enough to occasion a deposit sufficient to occasion its burning.

43. Did you not state that they unscrewed the tube in one of the engines?—Not the tube. I would beg to define, that by a tube, is meant a vessel less than a given area; those vessels which the Committee are pleased to call tubes in Wolfe's boilers, were of a considerable size, and come under the name of cylinders; therefore when I speak of a tube, I mean a vessel less than four inches diameter, or one within which water will not circulate without extra assistance; above that, I should call a cylinder. The arrangement of tubes effected, circulation and separation enable me to use thinness of surface, facility of raising steam,—and also any extent of surface when required, with facility of clearing of water as to be useful and valuable in an engine.

44. Did you not find that the caps were liable to break?—The first caps that I used were of cast iron, and they did break occasionally: the first set of caps that I used were subject to accidents of that kind; arising from accidental blows, they also having different properties of expansion under different temperatures, loosened their joints; but in the second boilers I substituted copper caps, and from that time no accident of their breaking ever occurred.

45. Were they not apt to leak?—Never; I presume you speak of the joints; they

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they were packed in a peculiar way, the expansion of metals at different temperatures, will occasion the breaking of most of the joints submitted to fire; but after being packed with a fire-proof elastic matter, which I introduced, namely, that of asbestos, in making the joints, the evil arising from expansion, and consequent leakage of the joints, was effectually removed.

46. Can you state what surface was required for horse power in your boiler?—I can state to the Committee from recollection the weight of a boiler which I made as an experiment, but the amount of surface of it I cannot at this moment recollect; the weight of the boiler was twelve pounds; it was got up entirely for an experiment, with thin copper tubes; a two-horse power was obtained from it. I do not recollect the surface it presented to the fire, although I know it was calculated at the time. It was arranged merely as an experiment for a particular object, with exceedingly thin copper tubes; the fire was urged by artificial means. This experiment showed distinctly that intensity of fire, with a limited surface, was an equivalent for weight, and the great extent of surface then generally believed to be necessary by engineers for obtaining a given power.

47. Have you any other observations to state with regard to the peculiarity of the boiler?—Having obtained smallness of heating surface and efficient material, and being enabled to overcome the difficulty of very small vessels for raising steam, I had only remaining to obtain a command of fire to keep up that intensity, which I had previously ascertained to be an equivalent for quantity; and with this view the centrifugal fan was first used. It is now used in many iron furnaces, instead of bellows or blowing cylinders. This was found inconvenient, from its room and other properties about it, and was superseded by passing the waste steam of the engines into a cylinder; here it acted by steady expansion, and produced a blower, and by directing its mechanical force up the chimney, drew after it, and consequently through the fire, a corresponding portion of atmospheric air. This latter contrivance is very superior to the former; it is under the power of the engineer, who can obtain an intensity of fire at pleasure. The intensity, then, of fire being obtained at pleasure, and it having been previously stated that thinness of surface giving lightness was rendered available, the great difficulties to which I have referred of applying steam on locomotion on common roads was overcome. I beg to refer the Committee to drawings and explanations given in in 1831 on this subject.

48. Was it not an additional advantage, that by putting the steam up the chimney, in connexion with the hot air, the steam became in a state of solution with the hot air, and thus passed out invisible, so as not to make any appearance objectionable to the road?—Decidedly; and to obtain this end previously by the waste steam from the engines, we were compelled to throw it very closely over the fire, so that being thus heated, it would be dissolved in the atmosphere passing through, and become invisible. The intensity of fire, however, produced by the second method, rendered this unnecessary; the steam was dissolved in the atmospheric air of the chimney, in the large quantity passing. It may be observed in regard to this point of solution of steam in the atmosphere, that in very cold hard frosty weather, the steam will sometimes condense, and appear as cloud about a quarter of a mile, more or less, in the air, after parting with the heat which held it in solution.

49. Do you conceive that the ground of the objection of a volume of smoke coming from a machine, and calculated to frighten horses, is obviated by the mode of rarifying the smoke as now explained by you?—There is no smoke visible. I might state perhaps this as one of the practical advantages and one of the practical points gained by subsequent experiment, which I could not include in my patent amongst a number of others.

50. So that, in fact, no dense smoke comes from your steam-engine when running upon the common road?—No smoke, for the fuel does not give it; and the steam being heated, dissolves in the atmosphere invisibly, and becomes a part of it.

51. With regard to the noise which is made by the carriage in passing along the road, is it such as is calculated in your opinion to frighten horses when travelling along the road?—As a general answer to the question, I may state, that during the six years of making my experiments, and when the machine at first was in a crude state, compared with what it was in the latter portion of the time, and when the experiments upon those points were necessarily made upon the

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the high roads, still not a single accident can be stated to have occurred; the noise from the high-pressure engine, as generally used, is very considerable; but by passing the steam into the blowing vessel that I have previously spoken of, the noise is annihilated, and cannot be heard.

52. Is there no hissing like that which you hear on board a steam vessel when the steam is let off?—If the steam was let off from the safety valve in the open air, there would be noise like that in a steam vessel. In a steam vessel they let it off in the air from the top of a tube going up the mast; but we, in our case, let it into a box, which has an opening over the fire; this so rarefies the steam, that it not only becomes invisible, but also inaudible.

53. Is there any thing in the shape of the machine going at a quick rate on the road which you think calculated to alarm animals, or which has practically done so?—In answer to that question I should refer the Committee to the body of evidence in a former Report, and state, that from all my experience since that period, I have had no reason to change the evidence then given, which was very full upon the point. In my opinion no objection of the kind exists.

54. In narrow or straight parts of a road, must not the liability to mischief, from the steam carriage coming into collision with other carriages, depend upon the steadiness and skill of the conductor of the carriage; and going at a quick pace of 12 miles an hour, is there not considerable danger that in the event of such a person not being either skilful or steady, a very serious accident would occur to the public?—The likelihood of accident in such situations would be much less with a steam carriage than with a horse coach; because the steam, being under the most perfect control of the engineer, and not having a will of its own, can be reversed at pleasure, turned backwards or forwards, or stopped instantly; whereas horse carriages cannot be so managed.

55. Going at the pace of 10 miles an hour, and coming within 10 or 15 yards of a horse carriage going at an equally quick pace, how suddenly could you stop your steam engine?—That question has been fully answered in the last body of evidence given before The House; the substance of which was, that it could be stopped in a shorter time, and safer than any horse coaches; because the full power of the steam instantly may be reversed, which, acting against the momentum of the carriage, brings it up more powerfully and safer than the reversed action of horses can possibly do.

56. What do you mean by the steam being reversed?—I mean that the steam shall be made to act upon the pistons, so as to reverse the action of the wheels; the same as by the common fact of steam paddles being thrown backwards and forwards in steam boats, to show the power which is technically called “backing,” or the turning of the steam.

57. Do you consider that it would be necessary to secure the public by any penalties for negligence on the part of the conducting engineer of such a steam carriage, in order to insure greater safety to the public in a machine of so novel, and in some degree what may be supposed to be of an alarming description of carriage?—I should say in answer to that; no. If any accident occurs, it must be through gross negligence; and under the laws already provided, he would be amenable: great culpability would be attached to him, and he would be punished under the same laws as to common coach driver.

58-9. Are you obliged to have an engineer to drive this carriage?—No; a man would learn to drive the carriage after half an hour's preparation; as a proof of this, I may state, that the celebrated Captain Ross, previous to his going out upon his last expedition, came to see the carriage then in experiment on the road. I had left the carriage for some purpose, when he got upon the driving box in my absence, and drove her off: he never had been previously upon it; he drove it for half an hour without my being able to catch it; he drove it with perfect safety.

60. Who managed the fire?—A man behind; the captain did not interfere with the fire; he seemed to have a preference for a colder birth.

61. It does not therefore require so much skill to drive this as would be required for driving four horses?—Certainly not; this question is fully investigated and answered in the evidence before the Committee of 1831.

62. Is there any other part of the carriage that in working makes a noise, such as is calculated to frighten horses?—There is no noise different from ordinary carriages, or peculiar in itself; I might instance the fact of having

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repeatedly been asked by persons on the road whether I had seen the steam carriage (when I have been walking along the road looking at it) pass; they were not aware that the steam-carriage had passed.

63. So that it does not appear that there is any more noise from any part of your steam carriage than an ordinary carriage?—None whatever; the noise is simply that of the boxes and wheels; there is no noise of the steam or of the steam apparatus. The shapes of the latter carriages which were made were so like the ordinary carriage, the common phaeton, that, as I have observed, it very often passed persons without their being aware that it was the steam-carriage.

64. With regard to danger likely to arise from persons travelling in the steam-carriage, do you consider that in the chance of accident to any of the boilers, or other apparatus, the passengers are liable to sustain great and fatal injuries?—I cannot see any chance of accident; as a proof of it, I beg to state, that at the end of 12 months after I began my experiments, I took my children to Stanmore in the carriage, and placed them close to the boilers. If I had been in dread of any accident of any kind from it, I should not have placed them there; I have had no reason to alter my opinion of its safety. From subsequent experience during the whole of the time that the experiments have been making, no accident of any kind has happened.

65. If one of the tubes were to burst, would not the hot water scald the people?—No; because the water under the pressure necessary to form steam for our purpose, expands itself upon the instant that it escapes into the atmosphere, and becomes not only æriform, but so changed in temperature, that it will produce the cold; ice may be produced by expanding steam in this way.

66. Has any explosion taken place from accidental circumstances, and what was the effect of such explosion?—The rending or opening of the tubes has often occurred, and in one case the head of a bolt bent aside. Through this opening, the steam and water escaped in sufficient quantities to drain the boilers dry in about two minutes; no mischief, however, happened, although persons were standing close to it at the time; it put the fire out, but the persons did not move away, so little were they even frightened. This I may state to be the greatest danger from accident that can possibly happen, or that has occurred during the whole of my experience since 1825, embracing a period of six years. I should also observe, that this happened when the carriages were in a state of experiment, and I may add were crude, compared to what they were after they were introduced into the public service.

67. Are your carriages liable to be overturned?—Not more so than the ordinary carriage.

68. Is the centre of gravity in your carriages higher with respect to the ground than in the ordinary carriages?—Not so high as a stage coach; the ordinary carriage is about the same. The stage carriage carries its weight upon the roof generally; there is an advantage in this with regard to the draft of horses.

69. Upon the whole, then, as regards danger, the centre of gravity is more safe in your carriage than in any public carriage?—Clearly so.

70. Do you have your wheels wider?—No, about the same width.

71. You could if you liked, could you not, have them wider?—There is no practical objection; we use wider wheels on some roads where it is desirable.

72. Reports have been circulated of accidents which have happened to carriages on the road from the fear of the horses in meeting steam carriages; have any such reports reached you?—Often such reports have reached me; and from sources that I cannot doubt their correctness; I presume it has been produced from carriages in a state of experiment by other persons, certainly not from any carriage of mine; for since 1831 I have not been engaged in the subject, nor have any of my carriages been on the road. The reports I have heard have reached me since my late visit to London. I unfortunately have the credit of the evil arising from many of the imperfect carriages which now appear experimentally.

73. Are you aware whether those other steam carriages by smoke or noise are calculated in a greater degree to alarm horses on the road than your own?—I have never seen any of them, and therefore cannot speak. If the effects which I have heard of are true, I should conceive that they must be so.

74. If, as you state, those objections have been remedied in your carriage,

so that no unseemly appearance or alarming noise proceeds from your carriage, and that other carriages have in those respects not acquired the same protection, do you not conceive that it might be necessary for the public safety to prevent any steam carriages from going on the common road, unless those objections were remedied?—When I first commenced my experiments I was particularly scrupulous on this head, and never suffered the carriage either to go out of my yard or out of the barrack-yard of the Life Guards, in which I was politely accommodated to experiment, till every objection or nuisance that I conceived likely to affect the public was removed. I thought, and now therefore think that experiments imperfectly matured on the highways and public roads should be prevented, otherwise this great subject of national benefit will be prejudiced in the minds of the people.

75. Do you see any means, without checking scientific speculations, in so far legislating on this subject as to prevent carriages from moving on the high road, unless they possess those qualifications which the Committee have heard in evidence from you, you conceive yours to possess, namely, that neither noise or smoke proceeds from them?—I conceive persons so coming before the public, would be amenable by some of the existing laws, and therefore that no express enactment would be necessary.

76. For instance, should you think it safe to allow steam carriages making little noise to move on the road at night, and what precautions would you take during the night?—I conceive that the appearance of the carriage by night would not be more objectionable or more likely to startle horses than those with ordinary lamps, such as used in stage coaches; because the fire is closed in the steam carriage and cannot be seen; the only light, therefore, by night would be that of the lamp or lamps as now used.

77. Do you conceive that there are any greater objections to using steam carriages on common roads by night than there are any other vehicles drawn by horses at night?—I think at first there might be a greater objection, because a certain directing power is submitted to the will of the leaders with horses; but with a careful driver and good lights I think the amount of increased risk is not worth consideration.

78. Does your carriage make more noise in the driver's ear than a common carriage with the horses running in front?—Not so much: minus the noise from the horses' feet.

79. Do you think that he could hear a carriage at as great a distance when driving that carriage, as a common coachman would driving on the box?—About the same.

80. Would you be so good as to make a brief abstract of all the questions regarding nuisances and danger asked you on the former Committee, and contained in the Report of the former Committee, and to put it in a brief state as your answer to this question?—In regard to danger and nuisances, all the witnesses examined by the Committee in 1831 agree, and the Committee report, "that steam carriages are perfectly safe for passengers;" that "the probability of danger from explosion has been rendered infinitely small;" and that "the danger arising from breaking of machinery need scarcely be taken into consideration;" that "they believe the reports frequently urged against steam carriages, in regard to the nuisance of smoke and noise from the engine, to be unfounded;" that "no smoke need arise;" and "that they have no reason to fear that waste steam will cause any annoyance."

81. It is asserted that there is danger in going down hill with your carriages; do you consider that there is any risk?—I do not. I must refer this subject to the extensive Evidence and Report of the last Committee; in addition to which I may state, that the calculations which have been made since that time, confirm the opinion of more safety with the steam carriage than with horse coaches; for the same reason that I have stated less danger to exist when meeting carriages in narrow streets, or whenever occasion may require to stop or reverse the motion of the carriage; in going down hills, any portion of the steam may be employed for retarding the velocity occasioned by its gravitation.

82. You are aware that in the navigation of the river by steam boats the legislature has interfered to regulate the speed at which they shall go in the crowded parts of the river; do you consider that it would be necessary for the public safety that some regulations should be made when steam carriages pass
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through towns or villages, so as to lessen the danger which might occur from a carriage with great velocity passing through a populous place?—As steam carriages can be stopped and set in motion with greater facility than steam vessels, and are more under the management of the directing engineer than horses by a coachman, I do not conceive an express enactment therefore necessary; but perhaps it may be well to give some power to the police, to restrain furious driving, as is now the case with the carriages in and about London.

83. Should you think that there was any objection to an enactment limiting the driving of carriages through the streets to a rate not exceeding eight miles an hour?—I think it would be well to do so.

84. Have you any index on the existing carriage by which the speed of the carriage is accurately ascertained?—We had no index actually applied, but the number of revolutions of the wheel, which is governed by the number of strokes of the engine, will always determine its speed, and in a short time will be correctly estimated by the directing engineer, or by any passenger in the carriage. An index, however, may be applied, if necessary or desirable; also a governor (I am now speaking technically) may be applied to the engines by which their speed could be determined, which will allow them not to exceed a fixed or certain rate.

85. Supposing that your vehicle were upset, what danger would there be of the passengers being scalded or burnt in consequence of the fire and steam and water being so near them?—The passengers being in a different part of the carriage, separate and distinct from the boiler, would not be likely to be injured by it in such an accident. For use in the public roads I have thought it best to have a carriage carrying passengers drawn after the steam carriage; in such case, when an accident occurs from upsetting; the steam carriage would be the first to suffer, and perhaps it might rarely happen in such a case that the following carriage would be upset at all; supposing it did so, the upset would not be more dangerous than under ordinary circumstances.

86. Is your carriage calculated to take any travelling carriage in tow?—Steam carriages may be built of different sizes and different powers. I am glad that the question has been asked, because it affords me an opportunity of stating what I might otherwise have forgotten; namely, that I anticipate one of the great applications of the subject will be, that of taking private carriages from one extremity of a journey to another, in lieu of the constant changing of post horses; this will be the result of practice I am convinced, principally from the fact of their being no expense in keeping when lying idle, if no other.

87. Do you think that it would be possible also by the same steam carriage, to transport a pair of horses belonging to a private carriage?—It is physically possible, but I think more expensive, and therefore not likely ever to take place.

88. In what sense would it be economically disadvantageous?—Because horses can carry themselves short journeys with greater economy than they can be drawn by a steam carriage. It is, however, possible, from the improvements that will take place on this subject, that this mode of transporting horses for private use at a distance, will be cheaper than the expenditure of their own muscular powers; for whether you carry horses or any other merchandize, it will be a question of comparative expense of fuel.

89. Is the injury which your carriages produce upon the roads, greater than that produced by common carriages?—It is certainly not so much; in support of which, I refer to the Report of the former Committee, in which Mr. Telford, M'Neill, M'Adam, and other scientific road-makers, I believe, gave their evidence.

90-1. Will you upon this subject of the comparative damage to roads, draw up a brief analysis of the evidence given in 1831, and if you have any reason from subsequent experience to presume that a different opinion has been come to, will you be so good as state it?—All the evidence in 1831 goes to prove that there is less wear and tear of the roads by steam carriages than by horse coaches; and the Committee say, that "such carriages will cause less wear of the roads than coaches drawn by horses." I have had no reason to change my opinion since this period.

92. With regard to the expense, what is the expense of the working the carriage?—The expense, taking the present cost of keeping horses, to which I presume

I presume the question applies, if at a rate of four or even five miles per hour horses are decidedly cheaper than steam, even if the locomotives can be reduced to 300 weight per horse power; but above this rate, the steam-carriages become proportionately cheaper; as the rate increases, in some ratio which is not yet decided, but far greater than a geometrical one. It is found that an increase of speed from eight to ten miles an hour with a horse coach, and the same increase by a steam coach, requires double expense with horses, while in the latter or steam power it will be the same.

93. What do you mean by requiring the same; do you mean that the expense per mile where you go at the rate of ten miles per hour or at the rate of twelve miles per hour for carriage, is precisely the same?—The increase of expense is so trifling, being a question of wear and tear, that I should say the same per mile, particularly over a good road.

94. Whilst the expense of horses increases in a greater proportion than the number of miles per hour?—The expense of horse power increases in a frightful ratio over the rate at which he travels; he is naturally and physically provided, I may say, with apparatus to carry him at a rate of two miles and a half to three miles per hour; if he is urged beyond this rate, he begins to lose free power or practical effect, which at the end of twelve miles an hour is extinct, and the whole of his animal or free power is then absorbed in his own locomotion.

95. That is to say, that a horse at twelve miles an hour cannot drag any thing?—He can do it as an experiment, or for a day or two in practice, but he could not continue to do so long.

96. How do you arrive at your conclusion with regard to the power of the horse?—I presume this question has reference to the power of the horse when applied for drawing carriages, either with a view to the better determining the comparative value of steam for locomotion on common roads, or the policy of legislating on the turnpike tolls, levied or to be levied on steam carriages, by some scale of horse power. Under this view, I would first observe, that the term "horse power" has been fixed by engineers to express certain work, or quantity of free or disposable force, at the best moving rate of a horse, namely, from two to three miles per hour and in a given time. This term was first applied to steam engines when the latter were fixed and used for mill work, pumping water, or such similar purposes. Where the engine itself was not required to move, the term "horse power" was calculated to deceive, and did deceive the first experimentalists on elementary locomotion; they associated with the term the actual power of a horse under all circumstances; and the same error seems to have interfered with the framers of the Turnpike Acts passed in 1831. Nothing is more natural than to overlook the fact, that a horse can only concentrate his power by a principle of vitality, and give out in one hour the quantity which had been calculated in the expression to be given out in eight hours; but that beyond his best natural rate, he would require a considerable portion of that quantity to be expended in carrying himself, in a ratio to be determined only by actual experiment and practical observation. This fact was not recollected, and therefore because a horse could draw a ton weight, and carry himself over the common road at the rate of from two to three miles per hour, a nominal one-horse steam engine was thought to be able to do the same. This conclusion produced gross mistakes in the first essays towards applying steam for locomotion on common roads; and evidently existed in the minds of some even in 1831. To arrive at the free or disposable power of a horse at a given useful practical rate of working as employed in the quick coaches and smaller carriages, is essential to determine the true political and mechanical value of any engine that is proposed to supersede or compete with it; and, secondly, the free or disposable power of the engine at the same rate, must also be determined. The expense of working, and the wear and tear of each must also be known before any true or just estimate can be made; in other words, what one by nature is, the other must become by art. To arrive at a conclusion with regard to the power of the horse, we must either commence our inquiry at a point of rest, or take one at a given rate of motion. A horse as a mechanical agent, is, in every sense of the word, a locomotive machine; for by locomotion only can he be made to give out his power, and as the expenditure of power required to propel himself at the rate of from two to three miles

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has never been determined, we have no data by which we can compute higher velocities; therefore in our first experiments on the subject of elementary locomotion, a series were made to ascertain the actual quantity of animal power mechanically expended by the horse to effect his own locomotion at given velocities over the common road. The principle of locomotion by which a horse moves himself, may be seen and investigated, by observing the reciprocating action of weights placed upon upright levers, or props resting on the ground, and moved alternately forward; the amount of power by thus placing given weights on the upper ends may be known by measuring the forces required to effect reciprocation, or, by calculating the same by the lines and figures necessarily described. A horse rests his body on his legs, and propels himself by describing an arc alternately on them as levers. The fetlock joint is the centre of the arc, and rests through the hoof on the ground. The hoof, during the time the arc is describing, by the shoulder or other joint, is stationary. There is no difficulty in imitating this natural movement by joints and levers, and measuring the actual power required to move a given weight; or it may be reduced to calculation.

Thus, suppose a given weight to rest on the upper end of the vertical lever *A*, (the other end resting on the ground) and that it is made to describe the arc *B*, *C*, *D*. The power or force required to move it up the first portion of the arc, namely, from *B*. to *C*. to the perpendicular, will be given out again, whatever it may be, on its descent through the second portion of the arc; namely, from the perpendicular *C*, to its termination *D*. This power is given to the weight, and retained in the shape of momentum; and like that in a fly-wheel in machinery, is distributed and expended in bringing the weight up the next or ascending portion of the arc formed by the succeeding lever. As the force thus retained is equal to that required to move the weight up the arc *B*. *C*., no fresh exertion or expenditure is required. From the second to the third, the third to the fourth, &c. the same effect is produced; and thus by one of the most simple and beautiful laws of nature, after the first movement, the horse requires no power to keep up his locomotion, except that of lifting his legs, and the friction in the centres of libration;—when it is seen how beautifully and effectually the ancle joint of man, the fetlock joint of a horse, and similar joints in other animals is formed; we first come to the conclusion, that the power required to be expended in their locomotion, amounts to little or nothing. Hitherto, the Committee will observe, I have supposed the leg or lever to rest on an *immoveable* joint; and the weight to move along a *level plane*. When, however, the lever rests on a *moveable yielding joint*, the arc described is imperfect; and we shall now require to correct our calculations. Any change by the yielding of the road, in practice, or alteration of the centre, while the arc is describing, will produce a distorted figure, instead of a perfect curve, determined by the time and change of position. An extra power will be required now to move it through the first portion of the curve to the perpendicular, which destroys the balance of ascending and descending forces; and the extra power will be *quoad* the distance sunk by the centre of libration; and the portion of the weight required for doing it. Again, in going up hill, the first portion of the arc, described by the lever to meet the succeeding one, in its perpendicular, is greater than the second in descending from it, the chord of which is not parallel to a horizontal line, but to the inclination; consequently, the power required to arrive at or lift it to the perpendicular, is greater than that given out by descending from it. The difference in the segments will represent the increase of power required, and will always be as the inclination. When a horse is drawing over a line, the arc described at his shoulder is not one the chord of which is parallel to the surface; for the descending portion of the arc from the perpendicular is greater than the ascending, in proportion to the power exerted; and in cases of strong draft, the libration commences at the very top of the perpendicular; in which case he has to lift his body again to the summit at every step he takes. The distance descended from the perpendicular, in a given time, will give the amount of power expended. The power required to move the horse, from these data, may be easily known; and also the power expended beyond it, when he is made to draw a carriage along a road. Without further detail, I will state, that, from these experiments and calculations, I believe the amount of power expended by the horse over our ordinary roads is equal to about

$\frac{1}{24}$ to $\frac{1}{30}$ his whole weight. Taking the weight of a horse at 1,200 (which is not far from the average weight) the power required for his locomotion at the rate of two miles per hour, will be about 50 lbs. This power of 50 lbs. added to 200 lbs. (the free or disposable power said to remain at two miles per hour) will give 250 as the representative of his actual power, if he could be made to exert the same without moving his body. A man can exert all his physical power when rowing in a boat, and by other similar operations. Thus, if it requires 50 lbs. to move the horse at the rate of two miles per hour, in an arithmetical progression, it will require an expenditure of 100 at four, 150 at six, 200 at eight, and 250, or his whole physical force, at ten. Practice does not vary far from these numbers, and it is only by a decomposition of power that he can be made to do any work at all at this rate. In coach work, or for the quick travelling purposes where steam power comes into competition, he is compelled to give out, in one hour, the same power that under ordinary circumstances he is allowed eight hours to expend; and thus, an engine doing the work of a four-horse coach for eight hours, may be said to do the work of thirty-two horses, and be called a "thirty-two horse power." To charge a toll at the rate of thirty-two horses for such a carriage, would be contrary, I think, to justice. The steam engine at Gloucester was a twelve-horse power, nominally so called, in effect, on the road, as compared to horse coaches; it was a two; namely, a "two-horse coach." This engine in the Cheltenham Roads Bill was charged 3s., and the carriage which it drew after it 3s. more; so that it had to pay 6s. toll, when a two-horse coach paid only 1s. 4d. The free or disposable power of an engine must be known, and brought in direct account with the aforesaid data of the free or disposable power of the horse; taking also into the calculation the observed peculiar operation of physiological laws, and those also of inorganic arrangement, before any true comparative estimate of the value of steam locomotion on common roads can be made. These data no doubt are known, or will be elicited by the Committee, from the scientific witnesses which they are about to summon before them.

97. What is the weight of your steam carriages?—The weight varies in proportion to the power; those equal in effect to a two-horse ordinary coach, which will carry as many passengers, will be about one ton.

98. A four-horse?—That will be about two tons.

99. That is empty?—Yes.

100. Do you consider that after rainy weather, or in thaws after severe frost, your carriage going on a common road would be liable to damage the road more than a common carriage?—Not so much.

101. Why so?—Because the tires of the wheels are wider, and from other reasons, which you will find fully detailed in the evidence of the last Committee.

102. As the breadth of the tire of the wheel causes less damage with a steam carriage, might it not be advisable to regulate the breadth of the tire of the wheel as is the case in heavy stage waggon, so as to make it the advantage of the owner of the steam carriage to do as little injury as possible to the common road?—I think that as the clauses in the various Turnpike Trusts having been determined by actual observation and experience, the same width of tire should be insisted upon with the weight of a steam carriage, and equal to that of a common carriage or waggon, in which the tire is compelled to be wide; but in steam carriages where the weight does not exceed that of the ordinary private carriage or stage coach, then there would be no necessity for its being wider; still there is no practical difficulty in doing it if it should be thought desirable by road proprietors.

103. In the event of a road up-hill being glazed over with ice, would you be able to go up that hill with a steam carriage?—Such a position is one that has scarcely been provided for in the experiments that I have made; but from a mechanical communication that I have received lately from a scientific friend, a Member of this House, I have no fears upon the subject; and I think a carriage might be made to go up an inclination of 1 in 12, supposing the same to be glazed or covered with frost.

104. In going down hill, what do you do?—Reverse the steam.

105. And you go down without dragging the wheel?—Yes, I must again refer to the evidence of the last Committee upon this point.

106. Have you any thing to state with regard to the originality of the invention?—Yes; when I stated that Mr. Trevithick may fairly and justly be con-

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sidered to be the originator of locomotion by steam on railways, I would refer the Committee to his evidence, to show that he had not been able to move on the common road, because that opinion may be entertained by some engineers: in page 63, he says, "Travelling on common Turnpike Roads would be by far the greatest national advantage, but which on the present plan never can be accomplished, because the difficulties of getting a supply of water, and the inequalities of the surface of the roads, will always, under the circumstances, prevent the limited power to ascend the hills, and this objection is irremovable, because as the power at present increases, the weight increases in nearly the same ratio:" then he says, "At the present moment we have a proof of this from the engines travelling on common level roads being as nearly as possible in equilibrium," which he supposed was the case at this time; therefore he evidently never started one himself, or knew very little about the practical or theoretical capabilities of steam carriages on common roads. Mr. Trevithick further says, in page 58, "I have noticed steam-carriages very much; I have been abroad for a good many years, and *had nothing to do with them until lately*, but I have it in contemplation to do a great deal on common roads. Railroads are useful for speed, and for the sake of safety, but not otherwise; every purpose would be answered by steam on common roads;" when he says, "I meant to do a great deal," it appears, from the evidence, that that is by condensing steam, and bringing it back in the form of water, and getting rid of the weight, showing that he was not aware of the state that the subject was in. It is important, so far as it goes, because I believe that the only person who can claim originality is Mr. Trevithick; he himself does not claim it. Perhaps I should not have referred to this evidence. Mr. Trevithick died since the Report of the last Committee.

107. Does that report of Mr. Trevithick's evidence contain his views and information on the subject?—Fully; and shows his proposition for condensing water after it had been used as steam, as being the essential for locomotion.

108. What do you consider to be the merits of the late Mr. Trevithick as an inventor with respect to steam carriages?—I have stated, in my previous answer, that I conceive him to be the inventor of locomotion on railways, that to him is due all that has been done on railways; and that at this moment the steam engines used on all the railways are decidedly those invented by Mr. Trevithick, with slight variation: at Manchester and Liverpool there is simply a substitution of a series of flues for the fire-flue, the one large tube, which he used. I consider Mr. Trevithick to be entitled to the gratitude of his country for such an invention, and I have no doubt that his invention will be followed by effects on society, scarcely credible at this moment; he must ever be considered as his country's benefactor. The high-pressure engine for which Mr. Trevithick has the credit, is the only one capable of effecting locomotion to any advantage, either on railways or on a common road.

109. What was the state of the question before Mr. Trevithick took it up?—Nothing, to my knowledge, was done; several reports and statements have been made by the Germans, Americans, Frenchmen and persons of other countries, all of whom are now anxious to claim the origin of this important subject. In a work lately put into my hands, a claim is made to the originality 40 years ago, but, unfortunately for the claimant, is said to have been done by a low-pressure engine; this engine must have weighed a ton at least per horsepower, say nothing of the water necessary for condensation, which would have been half a ton more. The Committee will observe this physical impossibility is an answer to this claimant; I have no doubt the others will be found to be of a similar description, and therefore Mr. Trevithick is the first who actually made a practical trial towards the subject at all; but although having failed on common roads, successfully applied it on railroads, to whose experiments the present success of railways, and rapid transit, entirely depend.

110. Are you aware of any other scientific persons who have engaged in this speculation of steam carriages, whose interests have been damaged by the legislative interference respecting tolls on the turnpikes?—After I had made some decided experiments on the subject, and had proved the practicability of applying steam for locomotion on common roads, and had overcome some of the great practical difficulties, the subject was taken up by several persons; I do not recollect all the names; amongst those who first followed after me, was Mr. Hancock; he, however, did not turn his attention to it until I had driven him repeatedly

repeatedly round the Regent's Park, and my carriage had gone up Highgate Hill; Mr. Ogle, whose evidence appears in the last Report, followed Mr. Hancock, to the best of my knowledge; but this can be spoken to by those persons who are better acquainted with the history of the subject than myself, because I have entirely confined myself to my own experiments and operations. Mr. Gibbs, whose evidence also appears, I believe did not succeed in making a successful experiment: Mr. Heaton, of whom one of the evidences speaks, tried, and it is said failed. Dr. Church has not, to my knowledge, yet been out. I do not believe that any of the engineers who have followed me, have established their carriages in the public service; they have been going on with their experiments since 1831, when I was compelled to retire from it; and, from the best authorities, it would appear that no great advance has been made in the subject from that time.

111. Are you aware whether any of those individuals, in consequence of legislative interference, have any positive claim on account of the loss which they have sustained by such interference?—I should imagine if the Legislature interfered with them, it would have stopped their proceedings, as it did mine; I cannot say.

112. Do you consider your invention now as so completed, that if you were to make a carriage immediately to run on the road, it would not be liable to much improvement?—Decidedly so; improvements will go on in the subject, I have no doubt, for the next fifty years; but the carriages are now so perfect as to travel faster, cheaper, and safer, than horse coaches on common roads; for the proof of which, I refer to the extensive evidence taken before the last Committee, and to a daily account kept of its proceedings between Cheltenham and Gloucester; and I beg to call the evidence of the conducting engineer, who kept it and had the management, and can speak to all the facts bearing upon this question.

113. What is his name?—Thomas Bailey; also to the letters and accounts received from Mr. Stone, already public.

Martis, 8^o die Julii, 1834.

SIR WILLIAM MOLESWORTH, BARONET,

IN THE CHAIR.

Mr. Goldsworthy Gurney, called in; and further Examined.

114. HAVE you any further observations to make with regard to your steam carriage?—I observe my last answer was to a question which has reference to the engines at Cheltenham, as to their practicability, and I should prefer referring this subject to other witnesses rather than myself; but as it is desired, so far as my opinion goes, I firmly state the invention perfect, at the time that it was stopped at Gloucester.

115. You stated in one part of your evidence that the success of your experiment induced you to establish a manufactory; have you any observation to make upon that?—The factory was established in 1826: in very large and extensive premises in the Regent's Park. The rent and taxes for the premises were about a thousand a year. I was induced to take so large a building from my conception of the importance of the subject, its certain practicability, and of its general introduction into the country.

116. Did you expect to keep so large a factory at work at steam carriages?—I did; and with that view I fitted it up with very extensive apparatus, the lathes and tools of all descriptions were very complete, and every preparation was made for carrying work on to a very great extent. Separate smithies were built at a great expense; the whole, with the tools, I think could not have cost much less than four thousand pounds. I have the accounts, which I can produce if necessary, by the clerk who was then in my employ. That property went on increasing in value with the experiments.

117. Did you make a sale of any portion of your patent?—I did.

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118. State the circumstances?—After the fact of steam carriages moving on common roads was proved, a few capitalists began to think seriously of it as a property; after the journey up Highgate Hill, by which the fact of their being able to be propelled up the steepest hills was proved, I sold one-sixth portion of the patent for 5,000*l*.

119. To whom?—To General Viney, now Sir James Viney.

120. In what year was that?—I think in 1826; but the date will be known by the agreement which I beg to hand in. This experiment decided the possibility of a carriage going up hills; it had been previously considered, that although carriages might be made to go upon a level, in consequence of my previous experiments; that they could not be made to go up hill; after this experiment in going up hill had been made, all the difficulties appeared to be overcome except those of a practical nature. This portion of the patent right with all the covenants in the assignment was afterwards sold by Colonel Viney to Sir Charles Dance. I shall state one covenant, and beg to read the clause in it, which will account for the carriage being first put on the Gloucester and Cheltenham road. I think this important, because the fact of its being established so far from the factory: so far from London; gave rise to an opinion that this particular road was selected, because it was a level hard road: this clause, however, will show that this was not the case; I produce the agreement which Colonel Viney afterwards passed to Sir Charles Dance, in which the road from Gloucester to Cheltenham is given exclusively to Colonel Viney. This road was made a special request by him, in consequence of his being a native of Gloucester, and having particularly requested the exclusive right to that road. Consequently when Sir Charles Dance possessed Colonel Viney's interest, he had sole possession of this road, and he put his carriages first on that road. This was the only reason why they were first established there; and it did not happen from the supposed idea of the road being a level one, or offering greater facilities for the carriage travelling on it than others.

121. When was the carriage between Gloucester and Cheltenham established?—The carriage was established after the journey I made to Bath, which was made in 1829; the carriage was established in the spring of 1831.

122. How long did it run between Gloucester and Cheltenham?—It ran for four months, with the exception of two journeys only, three times a day.

123. What prevented its continuing?—The passing of excessive tolls upon steam-carriages, was the cause of its withdrawal.

124. When did that change of toll take place which caused the stoppage?—In the month of June we received information by letter of this circumstance.

125. From whom is that letter?—From Mr. Jenny. I first received intelligence of the heavy tolls passing from Glasgow, by a letter to a Member of this House. I also had other information from the same place, at the same time, there was a contract entered into for the sale of the Scotch patent; and the parties interested wrote to us stating that they understood a very heavy toll was passing on the principal road from Edinburgh to Glasgow, that the Bathgate Road had levied a toll of 1*l*. 7*s*. on steam-carriages.

126. Have you that letter with you to which you refer?—I have. I then wrote to Sir Charles Dance, who was at Gloucester.

127. Did the persons at Glasgow break off the agreement with you?—They did. I wrote to Sir Charles Dance, Mr. Hanning and other gentlemen who had an interest in my patent, and begged them to come immediately to town to consult with me on the subject; in reply to which Sir Charles writes very hastily, and says, "I regret that I cannot attend your meeting to-morrow. But as I have much important information to communicate to you, I shall esteem it a favour if you will adjourn your meeting after any business you may feel it wise to transact, till Thursday or Friday next. I trust as I have attended the late meetings at much personal inconvenience to no purpose, you will do me the favour to agree to the adjournment I now propose for my accommodation. I take the liberty to suggest that it will be extremely desirable to determine on having an office," this shows the importance that the subject was then in, "and to agree to the terms of granting licenses immediately, as there are already many (and will soon be many more) applications in consequence of the decided proof of the practicability of running steam-carriages successfully from what I have done here. I will thank you to communicate to me by return of post to what day you determine to adjourn." We wrote to adjourn the meeting to the 7th July, at the request of Sir Charles Dance, and this is a minute of the meeting which I produce, signed by Mr. Hanning,

Sir

Sir Charles Dance and myself, stating, "that at a meeting held by adjournment on Thursday the 7th July 1831, at Messrs. Cockburn & Co.'s, Whitehall; present, William Hanning, Esq., G. Gurney, Esq. and Sir Charles Dance.—*Resolved*, That Petitions be *immediately* drawn up by Mr. Gurney, to be presented to both Houses of Parliament against passing Turnpike Bills, so as to become prohibitory to steam-carriages: *Resolved*, That this meeting doth now adjourn till 11 o'clock to-morrow morning." We were then in a very fearful and anxious state in consequence of having received this unhappy intelligence; therefore, we appointed another meeting the next day, to consult on the most prompt and best measures, Friday the 8th, in which is the following resolution: "meeting of Patentees of Mr. Gurney's Steam-Carriage, held this day at Messrs. Cockburn & Co., Whitehall; present, William Hanning, Esq., Sir Charles Dance, Goldsworthy Gurney, Mr. Charles Herring.—*Resolved* to adjourn over till Monday next the 11th July 1831, at 12 o'clock;" so that we met continually from day to day until I presented a petition to the House of Commons, through Colonel Torrens, which had the effect in a great measure of arresting the number of Bills which were in progress; but, unfortunately, several Bills had passed The House respecting most of the great roads on which I had formed contracts, and was about to run the carriages.

128. Were those Bills brought in on account of your steam carriage, or were they Bills that were passing at the time through Parliament?—The Bills were all brought in and passed after the carriage had run three months on the Gloucester road; previous to this time, the subject was scarcely credited throughout the country; but after the carriage had run constantly and successfully for three months, agriculturists and road trustees appear to have become alarmed.

128^a. You stated in one part of your evidence that it was the toll that prevented the carriage running between Gloucester and Cheltenham, but the Committee do not find in the list of the Bills at that period any mention of the road from Gloucester to Cheltenham?—The same week we heard of the Cheltenham Roads Bill amongst the number then passing through Parliament; I have an item in our Parliamentary agent's account, which I beg to give in, in which he says, "Conference with Mr. Gurney, advising on the course to be pursued, as well in regard to this Bill as to the Cheltenham Road Bill, and explaining the great expense that would be occasioned by opposition to the *variety of Bills* now in their several stages of progress through both Houses; advising an endeavour should be made to obtaining a *general Bill*, applicable to all roads."

129. By Appendix D. to this Report, it appears, that the Cheltenham Road Bill imposing a toll upon your carriage had passed previously to the Session of 1830 and 1831?—I do not know whether it was passed or passing; from Sir Charles Dance's letter, it appears that it was passing; I should observe that up to this, to the best of my knowledge, when we were running between Gloucester and Cheltenham there was no toll on the road; the toll, it would seem, had not then passed.

130. You mean that the turnpikes collected no toll?—No; the manager at the turnpike gate told the engineer, as I am informed, some time before this, that they intended to fill up the road first, and "if that did not stop him, they would get a tickler down from London;" I presume he meant an Act of Parliament. The carriage had, agreeably to this information, previously been attempted to be stopped by a conspiracy of parties interested against it; loose stones were put on the road 18 inches deep.

131. When was that?—June 21st or 22d. The carriage went through the stones three times; horse carriages and the mail it appears in the former evidence were stopped; waggons also; unfortunately the great strain required to get through such a formidable resistance, broke the axle; the carriage, however, was ordered to be repaired to resume its labours. Sir Charles Dance, shortly after, wrote me a letter, which at the time I printed, and speaking of the great hostility he had met with in various ways, concludes with saying, "I was resolved, however, not to do any thing hostile, if possible, and felt only pity and contempt for those who could resort to such means for preventing a great national undertaking; but as I was convinced the public were daily growing more pleased with the conveyance, passengers from all parts of the kingdom declaring their satisfaction and cordial wishes for its success, and the lower classes expressing their conviction, that the substitution of steam for horses would tend to their comfort and relief; it was my intention to have strengthened my wheels, and to have gone on in spite of any obstructions. But in the course of the following week, I learned that a vast number of Turnpike

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Bills had passed, and that more were passing through both Houses of Parliament, granting tolls upon steam carriages, which would be a complete prohibition; and that the Cheltenham Trust was one of the number. *Feeling that we were thus likely to be defeated by Acts of the Legislature*, in addition to the other difficulties, I relinquished my intention of continuing to run the carriages and hastened to London, where I arrived in time to consult with you as to your petitioning Parliament, which led to the appointment of the Committee of the House of Commons."

132. At what time was the patent?—June 20th; Sir Charles wrote to me on the 3d July, stating his reasons (for I thought it was necessary that the true cause should be generally known) by which the carriage was withdrawn. Here is a letter from Mr. Stone, who had then the management.

133. Have you the originals of those letters?—Yes; Mr. Stone thus writes to me, "I am exceedingly sorry to inform you that we have broke the hind axle. Yesterday morning we found the road filled up with loose stones for a considerable way near the four mile-stone. The carriage with difficulty went through them, and also returned through them again without any mischief, but the third time the strain broke the axle between the throws. The horse coaches have been stopped in the stones. The clerk at the Branch Bank of England says, that he came across by the mail this morning, and that it was also stopped. Mr. Todd, of Cheltenham, says, that he was obliged to get down from the coach he came to town by, and that the horses could not get it through. The Champion, from London, a fine four-horsed coach, was brought up, and in whipping to get through, broke the harness to pieces. Waggoners are obliged to get extra horses; in fact, the proceedings are most unaccountable. It is some relief, however, to know, that the steamer has gone through where horses have been brought up; and I hope soon to get the axle mended." Orders were given to have the axle mended, which Mr. Bayley, the engineer, can shew, if desired. Sir Charles then came to town to meet the patentees on the subject of petitioning Parliament, the resolutions of which I have put in. Sir Charles then, after having found that it was useless to attempt to arrest the Bills (for most of them had passed through the Commons) decided that an attempt should be made to bring in a general relief Bill, and until that was done Sir Charles determined to suspend his carriages; and in pursuance of this resolution he returned to Cheltenham, and gave orders that his carriage should be withdrawn.

134. What was the amount of the toll imposed on this particular road?—I cannot say at this moment.

135. Was it not the accident and the opposition of the trusts which caused that carriage to be given up, and not the amount of the tolls?—It was decidedly the amount of the tolls; we should have gone on notwithstanding all opposition if he had not. We did not care about the stones; we could have gone over them with very little extra strength; but seeing Government was determined to obstruct the subject we withdrew.

136. Can you bring any evidence of that fact?—Yes; the evidence of the engineer who received instructions to mend the axle, was to go on, and that Sir Charles Dance had given every necessary order to repair the axle, but that when he found that the information I had given him was too true, he returned and gave orders for all proceedings to be suspended. I observe, by looking at the Act, that the sum of three shillings is charged upon carriages of less number of wheels than three; the steam carriage is a four-wheeled carriage, there is no provision made for carriages of a greater number of wheels than three, which I do not understand.

137. From any communication that you received from different parties had you any reason to suppose that a toll would be laid on steam carriages, particularly between Gloucester and Cheltenham?—Not until I found among the list of Bills that were then going through Parliament the Cheltenham Road Bill.

138. Did you look then at the rate of tolls previously to writing the letter?—I did not look at that particular road; I stated simply the information which I received from Glasgow, which was that tolls were passing prohibitory to the running of steam carriages; the amount of 1*l.* 7*s.* was sent me from Glasgow, but I do not recollect communicating this sum to Sir Charles; I communicated that tolls of all descriptions were passing, and begged that he would come to London as fast as he could. It is possible he might have imagined the same toll was placed in the Cheltenham Roads Bill.

139. And that the tolls related to steam carriages?—So far as I had an opportunity of judging.

140. According

140. According to Appendix (D.) what would be the toll on your steam carriage on the Cheltenham Road, presuming that Appendix (D.) is correct?—Three shillings for the steam tug, and three shillings for the carriage drawn.

140^a. How many turnpikes were there?—I do not recollect.

141. What would have been the toll for a four-horse coach?—Two shillings and eight-pence.

142. If, instead of their being two carriages, your second carriage had been united to your first, the toll would have been 3s. the toll on a four-horse carriage being 2s. 8d.?—No; 6s.

143. Would that be a sufficient difference to have driven a steam carriage off the road?—I think alone it would not, for a fair distance; but for a short distance 6s. would. Two horse coaches only run between these towns; four-horse coaches run through. It is with steam indispensable to have two carriages.

144. You conceive that the tolls that were laid on your steam carriage were in the ratio of 6s., 2s. 8d. being charged upon a common four-horse coach?—Six shillings was paid whether the steam carriages were large or small: it might conduct a four-horse coach, or it might only conduct a two, the same toll was charged.

145. Your steam tug were in fact instead of four horses?—The steam tug was two horses; the other carriage the ordinary coach.

146. Do you know whether it was the opinion of makers of roads that your steam tug would do more harm to the road than the trampling of four horses?—Not so much; this point has been decided by the evidence in the last committee in 1831.

147. What were those other difficulties that he mentioned?—I presume the difficulty of local opposition which he met with from the turnpike trusts.

148. Was it not the local opposition and not the Acts of Parliament that stopped your carriage?—I have no difficulty at all, in answer to that question, saying; that the local difficulties would not have stopped us; we should not have minded them; in a great measure we had made up our minds, and anticipated that we should meet with some whenever we commenced running.

149. Do you mean to say that there were great roads upon which there were not those heavy tolls, but that they applied to all the roads on which you had contracted?—The Acts of Parliament that passed applied, I think, to most of the contracts more or less.

150. What contracts had you at the time that the carriage was made?—One was a contract entered into for the West of England, for carriages to Exeter and Plymouth from London; also to Exeter and Plymouth from Bristol, also from Exeter to Plymouth.

151. What do you mean by contracts?—Agreements entered into with capitalists, who took an interest in the subject; and were to put carriages on the road; orders were given me to build several.

152. Have you the contracts?—I have not all here, but I will bring them up.

153. Have you none of them here?—I have. The Committee will first allow me to trace the connexion between this contract and the tolls; because the Committee will find, upon the Exeter road, the Teignmouth and Dawlish road, and part of the road from London to Exeter, the toll was as much as 2l. 2s.

154. Had you a beneficial interest in the carriage running between Gloucester and Cheltenham?—None directly.

155. You derived no benefit from the profits and paid no part of the loss?—No.

156. Sir Charles Dance was the sole proprietor of that road?—He was.

157. Are there any persons, Sir Charles Dance not being producible, who are cognizant with his affairs on that trust, who you can produce here to the Committee?—There are.

158. Who is there?—Mr. Bayley.

159. Will he prove the amount of the tolls?—I am not cognizable how much he can prove.

160. Have you the original letter that Sir Charles Dance sent to you?—I have.

Henry Handley, Esq., a Member of the Committee; Examined.

161. ARE you acquainted with Sir Charles Dance's hand-writing?—I have corresponded repeatedly with Sir Charles Dance, and have seen him write; and I have no hesitation in saying, that this is his hand-writing.

*H. Handley, Esq.
M. P.*

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Mr. Gurney's Examination resumed.

162. IS the letter that you have delivered in to the Committee, in print?—No; the letter that I have delivered in, is the one which I received on the 3d of July, in answer to the communication from Sir Charles Dance. I requested him to come to town on the subject of the tolls. The letter printed, is from Sir Charles Dance. I can get persons who saw the original, or the person who printed it.

163. Sir Charles Dance's original intention was not to confine his speculation entirely to the Cheltenham road, but to extend it to other roads?—Certainly.

164. He considered this Act of Parliament as putting a stop to any probability of furthering the speculation on other roads?—I believe so.

165. Do you mean to say, that the impression on Sir Charles Dance's mind was not merely that the speculation which he had then in his hand would not succeed, but that from the acts done and the spirit shown in those acts, his impression was, that it would be useless to attempt to carry it on in any other road?—That was not simply his opinion, but the opinion of us all upon the subject.

166. And he did not, in fact, enter upon the other roads?—Not with a view to work.

167. What occurred in reference to the Cheltenham road, produced such an impression on Sir Charles Dance's mind, as to make him believe that the speculation in steam carriages was useless?—He did not. The Acts of Parliament had the effect upon Sir Charles Dance's mind, and also upon Mr. Hanning's mind; there is evidence enough to show that it was so; and there is evidence to prove that it was the case with several other gentlemen, if necessary.

168. Was he running that carriage as a matter of experiment?—So far as the difficulties requiring actual practice and observation went.

169. Have you any means of arriving at the profit and loss, during the time that it was running?—There is the engineer's account, who is at present in London; here is also a statement of the receipts and expenditure.

170. Did Sir Charles Dance's privilege extend to all roads, in addition to the Cheltenham and Gloucester?—He had one-sixth of the patent interest on all.

171. When Sir Charles Dance was in possession of one-sixth of the patent, in whom were the other five-sixths vested?—With me, with Mr. Hanning, with Dr. M'Kay and Mr. Thiselton, there were five patentees; the latter had small portions.

172. Did Sir Charles Dance become sole patentee of those patents?—No; he is only one-sixth owner.

173. In whose hands are vested the other five-sixths?—In the parties whom I have mentioned.

174. Do you appear here only for yourself, or on the part of the patentees?—I represent the patent so far as it is concerned.

175. Does Mr. Hanning still hold his shares?—His executor does; Mr. Hanning, I lament to say, died about three months since.

176. How much of the patent is in your own hands?—A considerable portion. The patent was divided into odd portions, in consequence of a portion to Mr. Stone, who was originally the engineer with me, having a fortieth given him in consideration of his services; he sold that part to Mr. Hanning; he sold this one-fortieth part of the patent for 1,000*l.*, the purchase of which can be shown.

177. When you were before the Steam Carriage Committee, was it after the accident had happened on the Cheltenham road?—It was.

178. Did you then give evidence as to the carriage having been given up on that line, on account of these Acts of Parliament which you state?—No, I did not; the question was not asked me; nor did I know then what Sir Charles's ultimate decision would be.

179. Were other persons engaged in travelling in steam carriages upon roads, deterred from prosecuting their inquiries or experiments on account of the Acts of Parliament?—I do not know.

180. Would not the same Act of Parliament which affected you also have affected them?—It would, if their carriages were the same as mine; if different in their construction, the tolls would be different; some proposed to carry their passengers; some were single bodies; some proposed three wheels; and others six wheels, and so on.

181. Has Sir Charles established a carriage since the year 1831?—No.

182. Has he not run a carriage?—He has made experiments for his private information, on particular points.

183. Is there not at the present time a line of carriages between Glasgow and Paisley?—I hear there is.

184. Is a steam carriage running between Glasgow and Paisley, liable to those heavy tolls?—I do not know.

185. The speculation on the Cheltenham road was instituted by Sir Charles Dance, as an experiment to prove the general practicability of running steam carriages on roads, with a view to the further extension of the speculation; and what occurred with relation to the Cheltenham road, made him abandon the experiment, not only there but every where else. Is that the impression which you intend to convey?—Yes; precisely so.

186. Do you believe from what you know, that that was the impression in Sir Charles Dance's mind?—I do.

187. Had you conversation with him at the time, and did you discuss the matter with him?—Yes, often.

188. Do you think that that was the feeling which led him to abandon the experiment?—Clearly.

189. You say that Sir Charles Dance has made experiments since 1831, what were those for?—I have not been in town since 1831 until now, and have had no opportunity of correctly judging.

190. Has he not established a carriage?—No; he ran a carriage from London to Greenwich for a short time, and it appears he attempted to run a carriage from London to Birmingham, but from information from engineers whom I have had an opportunity of seeing on this subject, it appears that he took the separator away from his boiler, at the recommendation of Messrs. Maudsley & Field; and in consequence of removing the separator, which is one of the great points in my original patent, the water came through the boiler, and the carriage stopped half way.

191. It was not one of your carriages which failed?—No; the cylinders were, but not the boiler.

192. It was not for the benefit of the company that those experiments were made?—No company in which I have any interest.

193. Supposing Sir Charles Dance to have succeeded either in the establishment of a steam carriage to Brighton or Birmingham, or in those experiments that he has made, and that he had established coaches to run generally on those roads, should you and Mr. Hanning, and the other parties, have considered yourselves entitled to share the profits?—If he had acted under my patent we should have been entitled; there have been attempts, it appears, to get rid of particular points of the patent, and to adopt other points in their stead as substitutes, to the great prejudice of the subject; but if any person was to use a steam boiler, in which the great points that I patented were not introduced, I do not think that either Mr. Hanning or myself would have any claim.

194. Do you happen to know whether Sir Charles Dance made any material alteration in the boiler?—I have no correct information, I have not seen Sir Charles Dance; the only difference I hear is, that he has put two boilers together; but that he has left out the essential part, namely, the separator. I presume there are engineers who can speak decidedly to this if they choose.

195. Are you aware whether Sir Charles Dance has taken out any patent of his own?—I hear he has taken out a patent in connexion with Mr. Field; I have had no communication with him to know.

196. In this last year?—I believe so.

197. That had reference to the boiler?—Yes; the fact is, that since the discovery, that the friction of the wheels was sufficient to propel carriages on common roads, all attempts to improvement have been entirely confined to the boilers.

198. Do you not conceive, from the circumstance of his attempting to take out a patent with reference to another kind of boiler, that he found your boilers to be imperfect?—No; Sir Charles Dance is no engineer, and he is constantly changing his opinions. I cannot say what induced him; I should think it was, for what he conceived to be, an improvement in certain parts; I think it is not Sir Charles Dance's patent; that there is an arrangement between Sir Charles Dance and Mr. Field, which made it somewhat necessary that the patent should be taken out in his name; but of this I can say nothing decisive.

199. Do you detect in the several Bills that passed any general scale by which the tolls were assessed?—No, they did not appear to have any data at all; in some cases they were laid upon the wheels, in some upon the weight, and others upon the horse power.

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200. By what sort of calculation was the highest of those tolls with which you were acquainted assessed?—The highest were laid upon the horse power, of which we have a nominal standard, and also upon the number of wheels, which appears to be “more or less.”

201. Can you give the Committee any one instance in which those high tolls were laid on, in which you understood how they were assessed?—On now taking up the list, I observe that the Exeter Road Bill has laid 6*d.* upon each wheel if the carriage does not exceed a ton, but if it exceeds a ton it is 1*s.*; if it exceeds two tons, it is 1*s.* 6*d.*; a common ordinary carriage weighs about three tons with its load, and pays 8*d.* to 9*d.* per horse, when the steam coach would have to pay 1*s.* 6*d.* per wheel, and there being eight wheels, that would be 24*s.*; the Teignmouth and Dawlish road is one on the western contract; there are others which charge the same; the Liverpool and Preston road, which charges the same; the Liverpool and Prescott charges 1*s.* 6*d.* for every horse-power, that being only nominal; if you fix the nominal horse-power according to the standard of engineers, it would make three guineas.

202. What is the largest amount of toll that you have ever known to be actually paid?—I am not aware, because when those tolls passed I was obliged as suddenly to withdraw from running.

203. Is not the great impediment to the general use of steam carriage the high toll generally demanded on your carriages when they were brought into action?—Yes, the actual objection.

204. Have you formed an idea in your mind as to what rate of toll should be placed upon your engines, so as to render it possible for you to compete with the common carriage power?—Yes; I gave this subject a full consideration during the last Committee at their request, who sat upon the subject, an appendix of which is affixed to their Report.

205. You received a letter from Sir Charles Dance, which is now printed, dated February 3d, 1832, on the subject of your steam carriage?—I did.

206. Do you remember that he there speaks of the success of the experiment between Gloucester and Cheltenham?—I do.

207. Do you remember at the conclusion of the letter, he spoke of the obstructions placed in his way by the public, and by Acts of the Legislature imposing tolls?—Yes.

208. Have you any objection that the letter should be put in as evidence?—Not the least.

209. What other contracts had you at the time when you made the Cheltenham contract?—I had a contract for the West of England.

210. Will you state the particulars of that contract?—The contract was for running carriages from London to Exeter and Plymouth, and from Bristol to Exeter and Plymouth.

211. With whom did you make this contract?—Mr. Hanning, of Dillington Park, Somersetshire.

212. Have you any proof of that?—Mr. Hanning's solicitor is in town, and, I believe, can show the contract.

213. What is his name?—Ellis; the terms of that contract are, that Mr. Hanning should pay 6*d.* per mile duty to the patent, for the right of running carriages, thus if a carriage went over a hundred miles, he was to pay one hundred sixpences for the exclusive privilege of running the carriage over that road; the right at Gloucester and Cheltenham was an exclusive purchase; there was no duty paid upon that road to the patent.

214. Was that all the contract with Mr. Hanning?—First he was to pay 6*d.* a mile; he was to have the carriages built by me; and he was to establish them upon the road as soon as they could be built.

215. Was that contract broken?—It was.

216. What was the cause of that?—The general suspension of the subject by the tolls; he refused to put the carriages on the road.

217. Can you prove that?—I can prove it by letters; Mr. Hanning is now dead unfortunately; also by evidence.

218. Can Mr. Hanning's man of business prove the contract?—I think he may possibly. Mr. Hanning's signature is fixed to the document, showing the lines of roads contracted for, which I have just put in. I may state upon this particular contract, the Act of Parliament imposed a toll of 1*l.* 4*s.* at the Exeter road, the Teignmouth and the Dawlish road, and the Totnes road, leading from Exeter to Plymouth.

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219. What did you estimate the value of the contract?—I estimated the value of this contract at 700*l.* for every carriage, per year; taking the number of the carriages that might be used for that road. A carriage would have gone upon an average 100 miles a day, which would have paid 100 sixpences, therefore you could not estimate it less than 700*l.* per annum.

220. Will you give the materials of the calculation?—The number of carriages could only be decided by the quantity of traffic. To supply Bath, I recollect it was estimated at 20, therefore for the supply of the West of England it would take a considerable number more.

221. What is the number of which you have an idea?—I should say 50 carriages would scarcely do it, taking the posting carriages into the account; and also stage carriages; I scarcely think that this number of carriages would be sufficient.

222. Then you think for that you ought to have received according to that contract 1,000*l.* per carriage?—Yes, in the shape of patent duty and manufacturing profit.

223. Will you give the data upon which you calculate the thousand pounds per carriage?—Twenty-five per cent. manufacturer's profit, in addition to the mileage.

224. You were to supply the carriage?—Yes; the price of the carriages was stipulated to be 1,000*l.* each; but in case I found from experience I could build them cheaper, or that smaller carriages were more useful, I was to do so; in all cases the manufacturing profits should be limited to 25 per cent.

225. The manufacturer's profit was to be 250*l.*; how do you make up the rest of the 1,000*l.*?—By mileage duty paid to the patent for the exclusive right of going upon the road, which would have amounted to 700*l.* and upwards per annum.

226. In your contract with Mr. Hanning, was he obliged to employ any number?—He was obliged to put on the number the public required; in case he failed to do so, I was at liberty to grant a license to any other parties.

227. Had you not the contract with you?—The original is at Bude; Mr. Hanning's solicitor, I think, can shew the counterpart.

228. In what way did Mr. Hanning succeed in defeating the completion of the contract?—When he came to town and attended the meeting, of which I have given the resolution; determining to petition Parliament, he stated that it was quite useless to attempt to introduce the subject in any roads while the principle of so heavy a toll was sanctioned by the Legislature; and, therefore, he proposed suspending it till the general Bill was obtained; instructions were given to our Parliamentary Agent to endeavour, if possible, to obtain a general Bill, the account of which I have stated previously.

229. Did you receive any consideration for the forfeiture of that contract?—No.

230. Was the contract fulfilled?—No, it was not; Mr. Hanning, when the General Repeal Act was thrown out of The Lords, refused to fulfil the contract.

231. Was there an agreement in writing?—Yes.

232. Was that conditional?—No, it was not; Mr. Hanning was fully satisfied with the carriage after seeing it perform the journey to Bath.

233. Have you any statement of Mr. Hanning's on the subject of his reasons for not completing the contract?—It is now so long ago that I cannot immediately put my hand on any written statement; but I know I have.

233*. Was there any public report of what Mr. Hanning said at that meeting respecting his tolls preventing him fulfilling the contract?—There was.

234. The contract was not completed, and Mr. Hanning refused to complete it?—Yes, after he gave the orders for the building of the carriages. The order was stopped, upon the passing of the Acts of Parliament.

235. Can you prove that?—I believe so. The clerk of the works, whom, if you please, I will send for, I think can prove it.

236. Had you commenced building the carriages?—Yes, we had laid down the carriages.

237. And immediately on the passing of these Bills, that was revoked?—All the proceedings were suspended, a panic struck us all.

238. Can you give any account of the loss in that contract?—The direct loss sustained by laying down those carriages, and the consequent sale of the property was about 2,000*l.* to 3,000*l.* The prospective loss, the Committee can judge of, perhaps, better than myself.

239. Upon that one contract?—Upon that one contract; it may be shown from the accounts in the books.

240. How many carriages were ordered?—Mr. Hanning ordered eight carriages, as well as I can recollect.

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241. What was the number of carriages on which you estimate this loss of 3,000*l.* to be incurred?—On the preparation that was made of forge work, and castings; the materials and preparations for the engines.

241^a. Do you mean that the manufacturer's profit would have amounted to 3,000*l.*?—No; I mean to say that the loss sustained in getting all the materials and laying down the carriages, and having the cylinders prepared and bored, amounted to from 2,000*l.* to 3,000*l.*

242. Did Mr. Hanning bear any share of that loss?—Mr. Hanning did not.

243. Who did bear it?—I bore it all myself.

244. How can you say that 3,000*l.* was lost on eight carriages which would have cost 8,000*l.*?—The loss, by a forced sale, on the materials that were had in; there was also the rent of premises, which was at the rate of 1,000*l.* a year; which must be taken into account; all will appear in the entries in the books.

Mercurii, 9^o die Julii, 1834.

SIR WILLIAM MOLESWORTH, BARONET,

IN THE CHAIR.

Mr. Goldsworthy Gurney, called in; and further Examined.

Mr. G. Gurney.

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245. HAVE you any thing to observe in addition to your evidence of yesterday?—I wish to observe, that upon looking over my notes, I find that the impression in Gloucester, on the part of Sir Charles Dance and those persons about him, was, that the tolls would amount to 12*s.* every time of passing the gates. The charge of 6*s.* was laid on the first turnpike, and if the Gloucester turnpike had also obtained the same clause, the toll would have amounted to 18*d.* per mile. This ground is a part of two roads; it would not have affected the steam carriage further than what was yesterday stated, if the carriage had gone on to Bristol; but there was no establishment on that road. Sir Charles Dance fitted up the establishments on his own roads, namely, between those two towns, and therefore was not disposed to work to Bristol.

246. Was a Bill brought in for laying on the toll on the other road?—I am not certain; the impression on his mind seems to be, that there was.

247. Then in fact it was a mixture of reality and of panic; of toll really laid, and of the panic of other tolls?—Yes; I have always given this version of it.

248. The Committee understand from your statement, that Sir Charles Dance was the person immediately affected by the legislation with respect to the Cheltenham Road?—Immediately so, as having established his stations on the road.

249. Then you were affected more with regard to other roads, and contracts upon other roads?—Yes, with the manufacturing profit for supplying the orders given.

250. Had you any other contract?—This contract with Mr. Hanning, which we yesterday left off with, I produce; the contract signed by Mr. Hanning, the original contract which is at Bude; there is a resolution, which I hand in, signed by Mr. Hanning; his roads are from London to Exeter and Plymouth; here is his signature; there are several witnesses coming up who will prove the signature. In regard to the mileage duty, I find I was yesterday in error. I did not then recollect that there was a change made in the terms of the patent duties. The patentees, since this contract was first signed, discussed the subject a great deal, and we thought that the mileage duty would occasion a vast deal of unpleasant feeling amongst the contractors, and a good deal of difficulty in getting it; we therefore thought it better that the power of the engine should be taken instead of mileage; and that the duty should be paid upon it; the power to be judged of by the quantity of water evaporated in a given

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a given time. This resolution, which I now put in, is signed by them, and goes to that point, showing that the water to be evaporated is to be equivalent to a certain power, and that the carriage fitted up with it upon the road would have to pay a sum equivalent to that, charged in the previous manner.

[*The Witness delivered in the following Paper.*]

Present:

March 1, 1830.

Mr. Hanning.
Mr. Gurney.

Dr. Mackie.
Mr. Thiselton.

Mr. GURNEY proposed, That the duties payable on steam carriages travelling on common roads, should be after the rate of 2*l.* per gallon of water evaporated by each drag within the hour, to be paid by the licensed builder; and the further sum of 1*l.* for every gallon as above, to be paid annually in advance by the person licensed to use the same: this to be in lieu of the original plan of one and a half for every single mile.

Mr. Hanning, Dr. Mackie and Mr. Thiselton, voted against the above; whereupon Mr. Hanning moved, That the above proposition of Mr. Gurney should be adopted, so far as regards the roads contracted for by

Mr. Ward	-	-	London to Manchester and Liverpool.
Mr. Bulnois	-	-	London to Brighton, Southampton and Portland.
Captain Dobbyn	-	-	London to Bath and Bristol.
Mr. Hanning	-	-	London to Exeter and Plymouth.
Sir Charles Dance	-	-	London to Birmingham and Holyhead.

This latter plan was carried by a majority of three; viz. Mr. Hanning, Mr. Thiselton and Dr. Mackie, whose signatures are hereunto added.

*W. Hanning.
Patrick Mackie.
Chas. A. Thiselton.*

251. You conceived that that subsequent contract would have been as advantageous to you as the other?—About the same; instead of the mileage, which was considered very difficult, and tending to produce unpleasant feeling amongst us, the duty was placed upon the power of the carriage, to be judged of by the evaporation of the water. Mr. Hanning was a patentee as well as contractor for the road.

252. Have you any observations to offer in regard to this contract?—That the contract was suspended on account of the turnpike tolls, I stated yesterday; I have no further remarks to add to them.

253. What other contracts have you to give in?—I did not expect this line of inquiry would have taken place, and therefore am badly prepared for it: on looking over the papers which I have, I find a contract for the Bath and Bristol road; the original, which I give in.

[*The Witness delivered in the same, which was read, as follows:*]

THIS Agreement, made the 10th day of September 1827, between Goldsworthy Gurney, of Argyle-street, of the one part; and William Augustus Dobbyn, of Wells, Somerset, Esquire, and Elias Thomas Peter Gurney, late of Wine-street, Bristol, but now London, of the other part: Witnesseth, That Goldsworthy Gurney, for his part, agrees to build eight substantial steam carriages, and to grant a lease for fourteen years of the same, for the sum of Four thousand five hundred Pounds, to William A. Dobbyn and E. T. P. Gurney; and also the right of purchasing them at the end of fourteen years, for the sum of Eight Pounds Eight Shillings; the said parties binding themselves not to run them on any road except between Bristol and London, according to the regulations set forth in the lease, which is intended to be granted generally, except only a duty of one penny per mile, patentee's duty. And the said G. Gurney binds himself to build any further number of coaches they may require on the same terms, for the sum of Six hundred Pounds each; they at the same time binding themselves to furnish the full number required by the public on the road from Bristol to London. It is clearly understood, that the said G. Gurney is not at liberty to grant any license to any other party (the mail excepted), which latter is to be considered the privilege of the said G. Gurney. The line of road intended to be granted, is from Bristol and Bath to London direct.

Witness our hands, this 10th day of September.

Francis Macerone, Witness.

*Goldsworthy Gurney.
W. A. Dobbyn.
Elias T. P. Gurney.*

254. With whom?—The contract is with Captain Dobbyn and G. Gurney.

254^a. What was the agreement?—The agreement is, that eight carriages shall be built and established between Bath and London and Bath and Bristol,

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by Captain Dobbyn and his partner, on the payment of the sum there stated; the original contract was afterwards changed, and Bath included; there is a premium to be paid in mileage duty. The premium first advanced being large, a smaller mileage duty was placed on the road.

255. Was there a premium laid on the rest that you have mentioned?—Yes.

256. What was the premium?—In all about 1,800*l*.

257. And you were to have that in hard cash?—I received that sum.

258. What was the premium on the road from London to Bath and Bath to Bristol?—Four thousand five hundred pounds in the shape of premium and advance for building carriages; the mileage terms were the same as stated. I received the premium for the western road, namely, from London to Bath and from London to Exeter.

259. Then the premium in hard cash you received on both those occasions?—I did, for which receipts were given.

260. What was the amount of the premium to Exeter?—It was lower than the others. It amounted to no more than seven hundred pounds in consequence of the full mileage duty of sixpence, which was to be paid for it; 1,500*l*. was put on for the premium between Bristol and Bath. Bath and London was the first contracted for, which was afterwards extended to Bristol. I should state, in continuation, that in consequence of the contract not being fulfilled, I was obliged to refund a large portion of that sum.

261. Why were you obliged to refund?—I was not obliged. The contractors were injured by the suspension of the subject with myself; and I conscientiously thought it right so to compromise the question.

262. Did you receive the 4,500*l*. from Mr. Dobbyn?—Yes

263. Upon what pretext did he demand that you should refund a portion of it?—It was a matter of feeling between us. I thought it was a hard case that the contract could not be fulfilled with advantage to him.

264. And therefore, without any obligation to refund, you gave it up?—It was a matter of mutual agreement, not of obligation; the whole was not given up, a portion of it.

265. How do you mean, matter of mutual agreement; did you give it up without being obliged to give it up?—Yes; I returned a portion.

266. How much?—2,000*l*. out of the 4,500*l*.

267. Have you any one whom you can produce to prove this contract with Mr. Dobbyn; is he alive?—He is, but not in England. Mr. Stone, my principal engineer, went to America to introduce the subject there, finding that we could not get on here; Mr. Dobbyn is gone out to him.

268. Could you not produce the signing witness, Captain Macerone?—Yes, to prove the signature of Mr. Dobbyn.

269. Is Captain Macerone acquainted with the contents of the contract?—I do not know that he is acquainted with the contents of the agreement; he was in the habit of often coming to the factory when my experiments were going on, and witnessed the signature.

270. Have you any thing more to observe with regard to this contract?—Nothing, except that I received back a proportionate right in the road.

271. What was the reason that Mr. Hanning's contract was broken?—The reason this was broken was directly occasioned by the passing of the turnpike tolls.

272. With regard to this contract of Mr. Dobbyn, why was that broken?—That was cancelled in consequence of the same panic; but not so directly broken as this.

273. Was any Bill actually passed in regard to either of those roads?—I think there were several of the private roads which affected them; I observe the first on the list just put into my hand, were contracted for to go through.

274. You have never given any particular evidence with respect to the change of toll?—On that particular contract I cannot.

275. In the contract between Bristol and London, was there any Act passed which increased the tolls?—I do not recollect. I do not know where the various local Acts for roads run to. I know that the Bedford road is a part of the road to Andover; but I do not know where the other roads which are named here extend to. Bedford road is a part of both.

276. Is

276. Is that between London and Bristol?—Through Andover to Bath; it is the shortest road; it is direct to Exeter.

277. Have you any evidence to prove that this contract was broken in consequence of any Bill passing, or of the increased toll?—That particular contract shared the fate of all the rest. I cannot bring positive evidence to show it at this moment.

278. Might not this contract just as well have been broken on account of your machine being found not capable of going well upon the roads, as from the turnpike tolls?—No, because the carriages were found to be cheaper to the proprietor who had established them, and there was no doubt about their success.

279. Save and except the breaking of the axletree, there was no fault to be found with the engine at that time?—There was an imperfection in welding the boiler tubes then used upon the carriage; some trifling parts of further arrangements on the carriage as to the bodies at that time; all of which were overcome after a little experience upon the road.

280. What was your next contract?—There is another contract that I can produce to-day; I have sent to other parties, but have not had an answer except from one of them. He says that the contract is in the hands of his attorney, and that he will be able to get it to-day or to-morrow.

281. With whom is the contract?—With Mr. Bulnois.

282. On what road?—From London to Brighton and Southampton.

283. Why was that broken?—I cannot of my own knowledge show that it was broken from the same cause as the others; but I presume the same panic affected Mr. Bulnois.

284. Can you state whether the tolls of the road between London and Brighton were increased?—At this moment I cannot.

285. Will you examine the list?—I observe Worthing and Little Hampton road in the list; I see a shilling a wheel is charged for every carriage: perhaps the Committee, as it was so long ago, will allow me a little time to see where these local and various roads run to; for I have no idea. Worthing was a part of this contract.

286. Can you bring any witness to prove that contract of the London and the Southampton road?—Yes, Mr. Bulnois will be able to do it if he comes. Here is the first contract I entered into; it is with Mr. Ward, from London to Manchester and Liverpool.

287. Had you a contract with him?—Yes, so long ago as 1825 or 1826.

288. Was that broken likewise?—It was not broken; the reason why that contract was not executed, principally, was on account of another negotiation which interfered.

289. That was not broken on account of the tolls?—No, the tolls on this road were not levied before a new contract was entered into; therefore the tolls were not the cause.

290. Do you not conceive that those bargains which you speak of have been rather broken by the individuals from their want of funds or from their want of confidence in your steam engine, than from any increased toll?—I do not, directly or indirectly; the panic at Gloucester put an end to almost every contract, sale, or negotiation that I had made; up to that time the contracts were regularly proceeding with and going on.

291. Had you any contract for Scotland?—Not for running carriages; there was a contract for the sale of the Scotch patent.

292. Was that negotiation broken off?—It was.

293. On what account?—Decidedly on account of the tolls.

294. Are there not steam carriages running at the present moment between Paisley and Glasgow?—I understand there are.

295. You say that there are carriages running between Paisley and Glasgow, in what respect do those impediments which stop you not stop them?—When I was stopped, these carriages did not exist, and therefore could not be affected by the same circumstances; they are, perhaps, now in a state of experiment; I was in a state of perfection four years ago; I had no experiment to make. I know many of the parties who are now running, as well as Members of this House, are under the impression that the Acts have been repealed; for the Repeal Bill having passed the Commons, gave that impression.

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296. Then you conceive that they cannot continue to run as soon as they make this discovery?—I cannot answer that question; it is a matter of opinion. That some are running for experiment is evident, since you hear of them to-day, and hear no more of them to-morrow. The carriages at Paisley I heard had stopped, but are now going on again, and this seems to show that they were partly in a state of experiment.

297. Have you any other contracts to produce which were broken in consequence of the Act?—I am in possession of none to-day that I can produce. I would state that there is a contract with Sir Charles Dance from Birmingham to London and Holyhead; I cannot recollect the terms, because it was made about the time (I believe the same week) that the carriage stopped at Gloucester; when we were all in consternation. I simply recollect that when he came up to the patentees' meeting, he requested to have that road, as he proposed to move the carriage there; I believe it was granted to him, but the terms of that contract I do not at this moment recollect; nor do I think it of much consequence, as I think they were contingent on the Repeal Act being passed.

298. Can you prove that contract in any way?—I will endeavour to find the documents.

299. You stated that the steam carriages had been brought, in your opinion, to perfection, but the perfection was not at the time of this accident, but subsequent to that you had made your improvements to the boilers; at what period did that perfection take place?—By the practice which we were gaining at Gloucester, pointed out some of the difficulties that could turn up only by practice; those difficulties were of no serious nature.

300. Then, in fact, you consider the invention as complete at that time?—I do, sufficient for general introduction.

301. And there was no doubt of its success?—Not the slightest doubt whatever, in my mind.

302. And in Sir Charles Dance's?—Sir Charles, I believe, had no doubt of success. The carriage will go on improving for the next hundred years to come, like all others; but the carriages then at work were capable of beating the coaches in time, were latterly running at a profit, and carrying the public at one-half the fares.

303. Can you prove that they run at a profit, taking into account the original expense of machinery and the wear and tear?—For the amount of wear and tear I refer to Mr. Stone's letter, which I have given in, in which he gives an account of wear and tear.

304. It is stated there as a mercantile statement, as a merchant would state it?—He gives the amount of receipts, and gives the amount of expenses.

305. Did he make allowance for interest of capital?—I will see.

306. And for the wear and tear?—He did.

[The Witness delivered in the same, which was read, as follows:]

“ I send you a continuation of my journal. We have made altogether 396 regular journies, making 3,644 miles in all; the number of passengers who paid fares, 2,666. Our receipts have been 202*l.* 4*s.* 6*d.*; our expenses in coke, altogether, 78*l.* One-third of this coke has been burnt in exercise and experiments when we were not running. I have taken the carriage to pieces to mend the axle, and find the engine not worn or injured, and, with the exception of the brasses on the crank, there has been no perceptible wear of any part.”

307. Why was the contract of Sir Charles Dance broken in regard to London and Birmingham?—I cannot say; I presume that which withdrew him from Cheltenham, namely, that which I have just stated.

308. What was the particular Act which caused him to give up that?—The fact of the Bill passing the House, and his understanding that the Cheltenham Bill had passed the House of Commons, and was passing the House of Lords, and that other Bills were passing at the same time.

309. Were any Bills passed after you presented your petition?—I do not know.

310. You stated in a former part of your evidence, that Lord Shaftesbury omitted the clause in the Tolls Bill?—I do not of mine own knowledge know it;

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it; I called upon Lord Shaftesbury, and exerted myself as much as I could to prevent their passing.

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311. Were any Bills passed after the determination of the Committee?—I believe not.

312. Had you any offer for contracts after that period?—No; I left London.

313. Should you not therefore infer, from the circumstance of your not receiving any offers for contracts after the Report of the Committee of 1831, that the public were impressed with the idea that your steam carriage had not succeeded?—Many were impressed with that idea, from the simple fact of their being withdrawn from Gloucester; but a vast number of the public knew the circumstance of the Bills having passed the House of Commons imposing prohibitory tolls; and afterwards that these tolls were never repealed, notwithstanding every exertion was made after the petition of mine brought in upon the subject. I recollect offers having been made to me from time to time since the withdrawal from Gloucester, and lately also offers have been made to me; but on inquiry the parties have found that the tolls are in existence upon the roads as precedents.

314. But only in some roads?—Only in some; the fear in the minds of those persons is, that the intention to lay tolls is still existing; and therefore, that if the carriage was established, the tolls would instantly be established upon that particular road. I do not fear this, but I have not sufficient capital or means of establishing the subject.

315. Do you conceive people suppose that, after the recommendation of the Committee in 1831?—The recommendation of the Committee has never been carried in the House; therefore they have a fair right to presume so. It is well known that the Committee recommended legislative protection to be extended to the subject, meaning a repeal of the tolls, and that a Bill was brought into the House of Commons upon that subject, and was thrown out; therefore I expect they think that the Legislature were disposed not to repeal the Acts, but to suffer them to remain, or to increase them.

316. Have you had any offer of a contract of any kind, since the stoppage in 1830?—Frequently; I had an offer last week from gentlemen who were about to run through the principal part of Sussex; they asked if the Acts were repealed; I said, no, they had not, but I had no doubt they would be repealed; and I had no fears that any Act of Parliament would be passed which would affect their roads. They said they would make inquiries on the subject.

317. Had you any other contract that you could give in, which you could support by evidence?—None lately, that I think essential.

318. Had you any premium upon the others, except the two first that you mentioned?—Yes; upon the Brighton road, and also upon the Birmingham road; 500*l.* upon one, and 600*l.* upon the other.

319. Were they paid?—Yes.

320. Did you refund any part of them?—No.

321. What do you consider that you lost on account of this contract?—I require time to answer that question; I have no one to assist me in this inquiry; and I hardly at this moment see the various points in which the losses were sustained.

322. Will you put in an estimate?—I will.

323. Where were you at the time all those Bills were passing on private roads?—I was in London during the greatest part of the time, but was not aware of the fact.

324. Can the tolls be fairly levied under the present Act?—I think they can; and I do not see any reason to alter the plan that I proposed in the last Committee.

Mr. David Dady, called in; and Examined.

325. WERE you Mr. Gurney's foreman in his manufactory?—I had the superintendence of the manufactory.

Mr. David Dady.

326. When was that?—I was with Mr. Gurney in the year 1824; the manufactory commenced in 1826, and continued till 1832.

327. Were you acquainted with any contract which Mr. Gurney had with Mr. Hanning?—Mr. Hanning had the contract for the Exeter and Plymouth roads.

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328. Were you ordered to make any carriages in consequence of that contract?—There were eight ordered.

329. Did you lay eight carriages; did you commence making them?—We nearly finished three, and laid down five more.

330. What became of those three?—They were remaining at the manufactory till the auction that took place.

331. At what period did you commence making them?—I cannot recollect that exactly.

332. It was not in the year 1830, or 1831?—One thousand eight hundred and Thirty-one is the year that we were practising them on the road to Finchley.

333. Were they made in consequence of orders from Mr. Hanning?—Yes.

334. You cannot state positively when you commenced making those carriages for Mr. Hanning?—I cannot recollect exactly; if I had my books to refer to, I could tell.

335. Have you your books?—Not here.

336. Where are they?—They are not here; they are in Mr. Gurney's possession, I believe; I have left him for two years; I have been in the country, and came up only yesterday; I have not had an opportunity of seeing them.

337. When did you leave off making those carriages for Mr. Hanning?—We had them in practice till very nearly the time that the manufactory was given up.

338. Were they ever sent to Mr. Hanning?—Mr. Hanning used to attend the practising of them upon the Finchley road.

339. Why did not Mr. Hanning take them?—They were not exactly finished, except for exercise, to practise the engineers; to learn to keep up the fire, and to go up and down the hills, to guide, &c.; we had a station at Finchley.

340. When was the manufactory given up?—In 1832.

341. What was the reason it was given up then?—I supposed that it was in consequence of the Turnpike Acts that were passed about that time; that is the only reason that I am aware of.

342. Was there much talk about the Turnpike Acts then?—Yes; in consequence of which, these carriages were not wanted.

343. You have spoken of those experiments at Finchley; did those experiments answer?—Yes, very well.

344. Were they made after the contract with Mr. Hanning?—Yes.

345. Were they made to convince Mr. Hanning of the practicability of those steam carriages going?—No doubt of it; Mr. Hanning went with them himself.

346. Was he satisfied that they would answer?—He appeared to be satisfied.

347. Did Mr. Hanning fulfil his contract with Mr. Gurney?—That I am not able to say.

348. Did he take the carriages?—The carriages were never taken from the manufactory.

349. Did you ever hear any reason assigned by Mr. Hanning for not taking the carriages?—I have heard it reported that Mr. Hanning did not take them in consequence of the Turnpike Acts; he thought it would not answer to run them.

350. Did you ever have any conversation with Mr. Hanning during the time that the experiments were going on in the road to Finchley?—Very often.

351. Did he ever speak to you on the subject of the success of the carriages?—He has remarked that there was no doubt of their success.

352. Those carriages were completed as much as they could be?—No; but they were in that state that we could practise with them.

353. They were fitted for experiment in rough; they were not completed as they would have been if they had gone on the road with passengers?—No; they would have been painted up better; and many little things would have been finished that were not.

354. How many steam carriages did you make?—I cannot recollect the number; from the beginning of the time to the end, we built a good many.

355. Did you ever have any communication with Sir Charles Dance?—Not much.

356. When

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356. When was the first time that you had any communication with him? —I do not think I have had any conversation with Sir Charles Dance since he returned from Gloucester.

357. When was that?—I think in the year 1831; I am not sure.

358. You say you laid down eight carriages at the time of this contract with Mr. Hanning?—Yes; but we built only three. I had instructions given to me to prepare materials for eight, which were laid down; but we did not finish more than three.

359. Was there much expense incurred in those preparations?—Yes, there was a great deal; there were castings, and many parts prepared in the manufactory ready to be put together.

360. Have you any idea of what the cost of those preparations was for those five carriages that were not completed?—Altogether there were several thousand pounds laid out in preparing, laying in stock for those carriages, &c.

361. What do you mean by several thousand pounds; was there more than six, or less than ten?—Perhaps four or five; but I cannot speak correctly upon that subject.

362. Had not Mr. Hanning a share in the patent?—I believe he had.

363. And a share in the manufactory likewise?—I am not able to answer that; I think he had a share in the patent; but that was a part of the business not in my department.

364. Are you acquainted with Mr. Hanning's hand-writing?—Yes.

365. Is that Mr. Hanning's hand-writing?—[*The Contract between Mr. Hanning and Mr. Gurney being shown to the Witness.*]—That is his signature.

366. Do you know whether Mr. Hanning shared a portion of the loss that was incurred by the sale?—No.

367. You do not know any thing about it?—No.

368. How much did those three carriages that were made fetch at the sale? —That I am not able to tell. I did not belong to the manufactory at the time. I attended the auction, but not officially.

369. Do you happen to know whether they have been brought into use since? —They were not sold whole; we took them to pieces.

370. Were they sold at a great loss?—Yes, no doubt of it. I saw a pair of engines, and the frame that they were fixed upon, sold for no more than 11*l*.

371. What was the prime cost?—The prime cost, with the fitting up, must have been more than six times that sum.

372. Do you think that the other parts sold in the same proportion?—I think the other parts sold at a greater loss, because these were the most important parts.

373. Can you speak as to any general panic throughout the country respecting those tolls?—I do not know of any panic in the country; it was a general panic amongst us and every body concerned with us.

374. You remember the Act of Parliament passing to impose the tolls upon the steam carriages?—Yes.

375. Do you remember whether, in the year 1831, the public in your neighbourhood became aware of a Committee that sat in the House of Commons endeavouring to put a stop to large tolls being imposed?—I do not know that the country was aware of it. I was aware of it myself in 1831.

376. Were the parties who were under the panic, generally speaking, in that neighbourhood made sensible of this difference of feeling in Parliament towards steam carriages?—I do not know; they were all in a fright about it.

377. You think they are in a panic at the present day?—I think they do not believe the Acts will be repealed.

378. That was the cause, in your opinion, that it was given up?—There is no doubt but that was the cause.

379. Were you on the Cheltenham and Gloucester road at all?—No.

380. Do you know any thing about that?—Only from report.

381. Just before the manufactory had stopped, had any of those carriages failed in any road, or broken down?—No, nothing of any consequence, except the axle broken at Gloucester.

382. What carriages had you running besides that running between Gloucester and Cheltenham?—I am not aware of any for hire at that time.

383. At the time this panic began with respect to the tolls, was it the opinion of people about there that the carriage was improving in the road to Finchley?

483.

—They

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—They were of that opinion that the carriage was gaining ground; that I know of.

384. Do you think the feeling of the country was turning in favour of the carriages or otherwise?—I think it was rapidly changing in favour.

385. Did Mr. Hanning object at all to any of the carriages being imperfect?—No.

Mr. Samuel Gurney, called in; and Examined.

Mr. S. Gurney.

386. ARE you acquainted with the contract between Mr. Goldsworthy Gurney and Mr. Hanning?—I am not fully acquainted with the contract, but nevertheless I know that there was a contract, and I called on Mr. Hanning at his house at Carlton-house Terrace to know whether he intended to prosecute his carriages or not; he told me that the tolls were so great, that for the present he should not proceed.

387. When was that?—It was early in 1831; as this may be thought to be said as interestedly to steam carriages, or to my brother, I beg to state I am willing to make an affidavit that this was the conversation I had with Mr. Hanning.

388. You do not know at what time in 1831 this conversation took place?—I do not know the exact date.

389. Do you know the terms of the contract between Mr. Hanning and Mr. Gurney?—No, I do not; I know that there was a contract, but the terms I do not know.

390. Do you know if Mr. Hanning was a sharer with Mr. Gurney in the manufactory that was established?—Really I do not know; I was merely there to assist and to aid him; but I did not enter into any detail with any contracts, or with his patents in any shape whatever.

391. Had not Mr. Hanning a portion of the patent?—I believe he had.

392. Do you know what number of carriages were laid down by Mr. Gurney?—There were three that were constructed and were running at Finchley; I think there were five others ordered.

393. What became of those carriages?—They were never completed.

394. Were they sold?—They were sold.

395. Were they sold at a much lower rate than what they cost?—Considerably; they were sold at a very considerable sacrifice.

396. Who bore that sacrifice, Mr. Gurney or Mr. Hanning?—Mr. Gurney; Mr. Hanning advised its being abandoned *in toto* from that time.

397. Did he make any compensation for the carriages that he ordered?—No compensation whatever.

398. How do you know that?—At least, I do not think that he did.

399. Mr. Hanning did not complain of the construction of the carriages; merely of the tolls?—Merely the tolls.

400. He stated distinctly that the tolls were of such amount, that he could not run the carriages?—He did; and that he would abandon it from that time.

401. Do you know for what roads he took the contract?—No, I do not; but I think it was on the western roads, generally, for which he took it.

402. Did he speak of any tolls in particular?—No; he did not speak of any tolls in particular; but he told me that the tolls, generally, were such that he could not, with prudence, go on any further.

403. Had you any conversation with him as to the success of the experiments which had been making on the Finchley road?—Yes; he told me that he was perfectly satisfied with the running of the carriages.

404. You were present at the trials?—Yes.

405. And he was present also?—He was not present at every trial; we were running at Finchley three or four times a day.

406. How long were those experiments going on?—From three weeks to a month; if not more.

407. When did you commence making the carriages for Mr. Hanning; in what year?—It was in 1830 and 1831, but I was not always at the factory, because I had something to do in France about this time; I came over in 1830.

408. Do you know Sir Charles Dance?—Yes; I know Sir Charles Dance.

409. Have you ever had any communication with him on the subject?—Never, on the subject of his tolls.

410. Upon the success of the steam carriages?—No; I never had any communication

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communication with Sir Charles after the stoppage at Gloucester, but I have had communication with Mr. Stone, who was Sir Charles's engineer at the time.

411. What was the nature of the communication?—I asked him whether he had a good opinion of the carriages, and whether he thought he could suggest any improvement; he told me as regards the machinery, that if he had to make another carriage he should put the same machinery precisely; and that he would engage to keep it in repair for 10*l.* a carriage per annum.

412. At what time did this communication take place with Mr. Stone, Sir Charles Dance's engineer?—It must have been soon after the time that Sir Charles Dance withdrew them from Cheltenham, when Mr. Stone came to London.

413. Have you ever had any communication with Mr. Stone as to the reasons why Sir Charles Dance withdrew from the Cheltenham road?—I understand that the local opposition that was shown him, damped him in some measure; but that his chief motive was that of the tolls.

414. Did you understand that from Mr. Stone?—I did; that the one damped him, but that the other decided him to withdraw.

415. What opposition do you speak of?—I understand that the road was good from one end to the other; that there were loose stones heaped up to prevent the carriage passing over.

416. Have you any notion of the loss sustained by your brother in consequence of laying down those carriages, and their being sold by public auction after these tolls were laid on?—Yes; the loss must have been considerable.

417. Can you at all speak to the amount?—I do not think that I could precisely say what the amount was.

418. Were you at Cheltenham and Gloucester?—No, never.

419. Were the tubes of the carriages fixed with asbestos at that time?—I think they were fixed with asbestos; we always applied asbestos about that time.

420. Did you ever hear from Mr. Stone that Sir Charles Dance was induced to give up the speculation in consequence of not finding it answer, or is your opinion distinct as to the point that he gave it up in consequence of the opposition that he met with, and the high rate of the tolls?—The latter, I understood, was his real motive.

421. You do not therefore think that as a speculation Sir Charles Dance gave it up in consequence of not finding it answer?—Not at all; on the contrary that he would have continued.

422. Did Mr. Hanning appear sanguine as to the success of the experiments before those tolls were imposed?—Very sanguine; especially when the steamer surpassed in speed the Bedford Times up the Highgate Archway; he suggested one or two experiments which he wished me to repeat regarding the mail.

423. Are you aware that Mr. Hanning made any other preparations for the carriages on the road as to stations, or entering into contract with any of the innkeepers or other parties on the Western Road?—I know that it was a subject that was agitated amongst them; but whether he made any real contract with those people on the road I do not know.

424. Was he sanguine up to the time of the imposing of the tolls?—Yes, he was always very sanguine up to the time when I saw him at Carlton House; I went thither at his request to see him; he determined then that he would suspend it for a time.

425. He never gave any other reason than the tolls?—The tolls was the chief; he spoke also of the local opposition; this local opposition that was shown he thought could be overcome; but the toll was the great objection on which he based his argument.

426. Did he mean as to the toll on that particular road, or the general road?—Generally.

427. He had a general share in the patent?—Yes, he seemed to think the Legislature would prevent steam power being available on the roads; that was the view that he had of it.

428. You conceived that an experimental thing, the one at Cheltenham, and that Sir Charles would have applied it to other roads as well?—He would.

429. Have you any further information to give the Committee, by which you can show that the tolls caused a very heavy loss to the inventor, your brother?—I do not know that I have at this moment, which I could directly speak to.

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Mr. Hanning's was the particular case in which I interested myself, because Mr. Hanning was a large capitalist, always very friendly to me; and interested himself much in the subject.

Mr. William Bulnois, called in; and Examined.

Mr. W. Bulnois.

430. YOU entered into a contract with Mr. Gurney to run carriages?—Yes, on the Brighton and Worthing roads, and the London, Southampton and Portsmouth roads.

431. In what year did you make that contract?—I cannot remember, but I should imagine about the year 1829 or 1830.

432. Was it a written contract?—Yes.

433. Did you give a sum of money in consideration of the contract?—Yes, I paid 600*l*.

434. What were the terms of that contract?—Really I cannot tell the terms now; I have not the contract; I had the summons to attend this Committee only last evening.

435. In whose possession is the contract?—I think in my solicitor's.

436. Cannot you speak generally as to the nature of the contract?—Yes; I think we were to pay 6*d*. per mile for mileage.

437. Did you run any carriages between London and these places which you mention?—Never.

438. What prevented you from doing so?—There were never any carriages built; Sir Charles Dance was the first who was to make the experiment.

439. Did you not order them?—I did not order any carriages; I was not to have mine till other parties were supplied; Mr. Hanning and Captain Dobbyn were not to be supplied till Sir Charles Dance and the others were to have their contracts fulfilled in succession.

440. What prevented you from having carriages to run upon these roads?—There were various reasons which prevented it; the thing seemed to have been suspended before those people were supplied; and as I was to follow, my supply did not take place at all; I did not ask for those carriages. I paid 600*l*. in consideration of having carriages running on these particular roads, Mr. Gurney agreeing not to allow other people.

441. Why was it not carried into effect?—The thing was given up by Mr. Gurney. Sir Charles Dance was working carriages on the road, and my understanding was, that there were tolls levied, which obliged him to withdraw.

442. Was it the tolls that were levied between London and Brighton, and London and Southampton, which prevented you from asking for the carriages?—No, that was not the circumstance which directly prevented me; when those tolls were levied upon the coaches, it caused a reaction, and cessation in the works altogether; the thing seemed to be given up, and was suspended from that time.

443. Then it was not that you abandoned your contract, but Mr. Gurney could not fulfil it?—It was of no use to have my contract fulfilled; because if these tolls were extended, we could not work on the roads.

444. Were there tolls levied on the London and Brighton road?—On the Worthing road there was, but I do not mean to say that that was the specific reason why I abandoned my contract with Mr. Gurney; I do not consider that abandoned now; but the fear of the tolls, it was said, was the principal cause why Sir Charles Dance withdrew the working on his roads.

445. If those tolls were not levied on the Worthing road, would you still go on with your contract?—That would remain doubtful now.

446. Do you conceive that the invention is so perfect, that there would be good chance of success?—I do not know; I have almost given up the subject since.

447. Should you in 1831 have thought of it?—If the thing had not been stopped as it was, I should have continued it.

448. Do you take any interest in the subject of steam?—Not at all as a science; I have a general idea of it; I took the thing up as an investment; I thought it would answer, and I went into it on that principle.

449. You have stated that you did not apply to have your contract fulfilled for building those carriages, because you saw the subject was abandoned by Sir Charles Dance and others; are you aware of any other cause that induced Sir Charles Dance to abandon the carriages on the Cheltenham road?—No,

I am

I am not aware; I believe he was making other experiments; the reason why he withdrew his carriage from that road I understood to be, on account of the tolls; it is long since this occurred; I have only a general impression, from going backwards and forwards to the factory, and hearing the statements of the tolls being levied, and the legislative difficulties thrown in the way of the parties who were connected with Mr. Gurney; I consider that the subject was then carried on by those parties; by Sir Charles Dance and Mr. Hanning more particularly.

450. They had a share in the manufactory?—Yes, I believe they subsequently had a share; Mr. Hanning, not Sir Charles Dance; they seemed to withdraw suddenly; the whole thing to be abandoned; the reason was, I should say, on account of the tolls.

451. Was the abandonment simultaneous with the imposition of those tolls?—It was so.

452. Has Sir Charles Dance made experiments since?—Yes; he has been making experiments since for his own amusement.

453. With Mr. Gurney's steam carriage?—Yes, upon an improved principle, or what he considers to be an improved principle.

454. Having entered into this speculation, of course you made considerable inquiry as to the success of Sir Charles Dance's carriage on the Cheltenham road?—I did, but I cannot say that I knew the exact state of its success; I knew that he continued to work well for a long period.

455. Did you ever hear his abandonment of the Cheltenham road attributed to want of success in the carriage?—I should say that it was not; for that he had a great opinion of it, and I believe is now building other carriages to work on roads.

456. Have you ever had any personal communication or written communication with Sir Charles Dance?—Frequently.

457. What was the period of your last communication?—Perhaps four or five months since; it may be less.

458. Do you think he has a good opinion of the merits of Mr. Gurney's invention?—I think he has a better opinion of his own; there is a trifling improvement in his over Mr. Gurney's, I should say very trifling, in the formation of the tubes, putting them together in a different manner into the boilers.

459. Did you ever put the question to him, as to the causes of his abandoning the Cheltenham road?—I am speaking more from presumption than from the exact question having been put to him. I have no recollection of putting that exact question to him in that way; the thing was spoken of, and I know his intentions seemed to have received a great change from knowing that the tolls were levied.

460. From your general impression of the tenor of your conversations with Sir Charles Dance, your opinion is, that the real cause of his abandoning the Cheltenham road was the imposition of those tolls?—I should say, that, with other circumstances; I do not know that, but I am speaking now generally from my communication.

461. What were the other circumstances?—For the purpose, I should say, of making further arrangements; but I do not know.

462. Then you do not think that the speculation was so certain of success?—I never saw any thing about the coaches working at Cheltenham or in this neighbourhood.

463. Is there any thing in Sir Charles Dance's improvement that would take it from under the influence of Mr. Gurney's patent?—That I cannot say; Mr. Gurney is not alarmed; each is equally sanguine; Mr. Gurney is improving his. I think if the thing were going on for years, it would go on improving, and be comparatively more perfect every day.

464. Then it is your decided opinion that the improvement was stopped by those tolls?—Yes; that was one of the great causes, I may say the great cause, with Sir Charles Dance; the whole thing seemed at the time to be abandoned; all the parties concerned seemed to be at fault; they did not know what else they were to do.

465. You say that you only received the summons last night to attend this Committee, and that you have received letters from Sir Charles Dance on this subject; could you, if time were given to you, peruse those letters of Sir

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Charles, to give the Committee more accurate information of the cause of abandonment?—I do not think I could; I do not think Sir Charles's letters go to that at all; and I do not believe I have any letters by me; they were friendly communications more than business communications, because I was not connected in any way with Sir Charles in business.

466. What was the extent of the contract with Mr. Gurney?—I paid six hundred pounds; I was to have coaches after the other parties, Sir Charles Dance and Captain Dobbyn, were supplied; I should have had to pay the price of my coaches; six hundred pounds was the deposit.

467. Have you not lost that?—Mr. Gurney I conceive owes it to me.

468. How many carriages should you have speculated upon?—I should not have gone into a greater extent than having three carriages at first; we could not work less than that; I was not alone in this undertaking, there was another gentleman concerned with me.

469. What was the other road that you contracted for?—Portsmouth, Southampton, Worthing and Brighton.

470. How many carriages would be necessary for the Portsmouth and Southampton?—I cannot say off-hand; at the first we should not have built many carriages; as many carriages as would have been necessary would have been supplied from time to time.

471. If the imposition of those tolls had not placed a damp in the way of improvement, which you think would have taken place by this time, how many carriages do you think would have been built for those roads?—That I should say would depend upon the improved speed we had arrived at, because I consider in bringing a thing of this sort out, there would be a great many difficulties; Sir Charles Dance encountered a great many difficulties and overcame them; I think by this time, had the thing gone on without any impediment, we might fairly have considered it brought to perfection; it would have required a great number at this time.

472. What would have been Mr. Gurney's profit?—I cannot say; but I should think very large; that contract was altered from sixpence a mile; there were circumstances which induced Mr. Gurney to put the mileage in another shape; it was according to the evaporation of water.

473. Would the wastage have been equivalent?—I think not so much; but if the thing had gone on, Mr. Gurney must have made a large fortune had he had only a penny a mile upon that.

474. Then the impediment to his prosperity was attributable to the imposition of tolls, which broke up the speculation or the running of carriages on the Cheltenham road?—I cannot say that for a certainty; Sir Charles Dance working his carriage for a great time, proved that those carriages were running with success; and I think now it is incapable of doubt, Mr. Gurney must have made a great sum of money up to this time; if they ran, certainly by this time Mr. Gurney would be making a great deal of money; perhaps not have made a great fortune, because the coaches take a long time in building.

475. Before you paid that 600*l.* for the deposit, had you not satisfied yourself that the experiment for practical purposes had answered?—Yes; or I should not have paid the money.

476. Therefore to that extent of practical use on the road, the carriage was in a state of perfection up to a certain point?—Yes; they were in a sufficient state to justify their being run on the road; Sir Charles Dance continued to run there for a space of four months.

477. Have you heard Sir Charles Dance state his good opinion of the invention?—Yes; and he has spent a good deal of money upon it.

478. You have spoken as to your impression of the nature of those tolls; had you any other impediment as to tolls to London, except the tolls upon the Worthing road?—I think there was so considerable a panic amongst the managers of this concern, with Mr. Gurney, that they seemed to feel that many difficulties were to be thrown in the way; and these tolls an almost insurmountable one; I speak from impression; I was only there to see that they were progressing towards furnishing me with coaches.

479. Were there any tolls on the Portsmouth and Southampton road?—There was on the Worthing road; I am not aware whether there was on the Portsmouth and Southampton road.

480. Have you any reason to suspect that they would be given up on their part?—

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part?—I have no reason, except that it seemed to throw a damp on all speculation.

481. When you say that a damp was thrown on the speculation, do you mean to say that you apprehended that when you commenced to run your carriage upon the Worthing road, you would be met by the same imposition of tolls that had taken place on the Cheltenham?—I cannot say that I had considered as to that. I should say that it was not the direct reason why I abandoned my speculation.

482. You abandoned the speculation because Sir Charles Dance abandoned his road?—I may say so, because the whole thing seemed to subside.

483. And Sir Charles Dance abandoned his road because of the tolls?—That was the principal reason.

484. Did you attend the experiments at Finchley?—Frequently. I went with Mr. Gurney to Bath also.

485. There was no toll demanded there?—I do not think there was any toll paid on the road at that time; it was merely an experiment; he was three or four times at least there.

486. What was your reason for abandoning?—That Mr. Gurney abandoned the thing and went to Cornwall; so I understood.

487. And you could not get your carriages?—I did not make any application for them; the impression on my mind was this: there were parties to be supplied with carriages besides myself; if Sir Charles Dance and Captain Dobbyn had found those coaches run with success, I should have been very glad to have been supplied by Mr. Gurney with coaches to go upon those roads. I was glad there were other parties to have their contracts fulfilled before mine; so that I might be more certain in the speculation, and therefore it was not directly on account of tolls that I abandoned my speculation; but it seemed to me that it was on account of the tolls; it might be for want of money; I saw no reason to think so; that the thing seemed to be abandoned at the factory, and I abandoned the idea of getting my carriages; I was taking up the thing as a speculation.

488. You never applied to Mr. Gurney to have the carriages made?—No; nor did I send Mr. Gurney an order.

489. In what way did you find that the manufactory was given up?—By finding that the subject was shut up.

490. Did you go up to apply for carriages?—No, I did not; if the thing had gone on, I should have given my orders as a matter of course, and reaped my profits; but as the thing seemed to be abandoned, I must bear the loss.

491. You do not deviate from the statement you before made, that when you saw Sir Charles Dance abandon the Cheltenham road, that induced you to abandon the other?—It certainly was abandoned in this way. If Mr. Gurney had kept on his factory, I should suppose that sufficient inducement would have been made in all probably to have justified me in giving my order; Mr. Gurney discontinued going on with the factory; it seemed to me, from one reason or other, that he had inevitably given the thing up.

492. Do you consider Mr. Gurney indebted to you for 600*l.*?—Yes, certainly.

493. Could you legally recover it at this moment?—That I am not prepared to answer. I should be sorry to apply to Mr. Gurney by a legal remedy; I have a good feeling towards him; I know the gentleman who is connected with me has; and I am sure he would not ask him for it.

494. Have you any reason to suppose that the carriages would not have been furnished to you if you had applied for them?—We must first have paid the money for the carriages.

495. Mr. Gurney was to have a profit upon the manufacture?—Yes.

496. To what extent?—The price of the carriages was not defined; I am not speaking positively; there was a sum nominally mentioned as being the probable price of the carriages; and as improvements were made, the price would be less.

497. As a speculator, when you found that certain Parliamentary impediments had been placed in the way of your speculation, would you have gone on with that speculation if you had been in Mr. Gurney's situation?—Decidedly not; I do not know whether it was Mr. Gurney's opinion or those who were connected with supplying him; but I think when impediments, and especially Parliamentary impediments, are thrown in the way of infant inventions, they look rather terrible.

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498. Do you wonder at Mr. Gurney's forsaking his manufactory under those circumstances?—Certainly not.

499. Have you any hesitation in your mind to attribute the cessation of Mr. Gurney's invention to the imposition of tolls, or do you consider that there were other causes, or that that was the chief cause?—No man will pretend to say that there were no other, no question of it; and it is possible one of them might be imperfection in the state of the coach, but I do not think so.

500. Have you ever read the letter which has been printed of Sir Charles Dance to Mr. Gurney, dated February the 3d, 1832?—I dare say I may; but till I had the summons put into my hand, I have so got rid of all recollection of it, that I do not know whether I have or not; Sir Charles Dance's feeling I know was very decided up to the time that I last saw him.

501. The following is the passage to which the Committee wish to call your attention: "My steam carriages ran between Gloucester and Cheltenham regularly four times a day for four months, from the 21st of February to the 22d of June 1831, during which time they carried nearly 3,000 persons, and travelled nearly 4,000 miles. They performed the distance (nine miles) in 55 minutes on an average, and frequently did it in 45. There were sometimes delays, owing to defective pipes in the boiler, which prolonged the time, but no accident, hurt or injury ever happened to any person whatever; the engines were never out of order, and are as perfect now as they were at first. Steam carriages can be worked profitably so as to carry passengers for one half of the prices at present charged by horse coaches."?—Yes, I have read that before.

502. From the recollection of your conversations with Sir Charles Dance four or five months ago, have you any reason to think that he deviates from the statement which he made in 1832 in this letter to Mr. Gurney?—I should say no; others may have impressions different from him, because they had not so good an opportunity as he had of seeing it.

503. You think he still entertains the same opinion?—I think he does.

504. You do not still retain that opinion yourself?—I am not so sanguine in the matter as I was before the thing had subsided with the public.

505. Have you no other reason but that for your opinion?—I have seen a great number of experiments, and I think there are some practical difficulties in the way which the first persons who encounter will have to overcome.

506. You speak as a speculator entirely?—Yes.

507. Do you think the subject has deteriorated rather than advanced since Mr. Gurney has given it up?—I think that it has gone back.

508. Have you seen any engines in your opinion superior to Mr. Gurney's?—I have seen nothing that has done more than Mr. Gurney's; I went with Sir Charles Dance's engines to Brighton in this last year, and I must say, up to the time of our breaking down, it was superior to Mr. Gurney's, considering the distance; I have seen Mr. Gurney's go as well for a short distance.

509. Was the breaking a trifling accident or not?—No; the machinery gave way. There was no fault in the invention, or in the thing itself.

510. Was it not by suddenly reversing the steam in going down hill?—Yes; they were going down Slaughten Hill at a great pace when they reversed the action of the engine, and it strained the piston-rod very much. Afterwards it broke. We went some distance after we felt the shock; but I said to Sir Charles Dance, something must have gone wrong. We were going down the hill at the rate of 16 or 17 miles an hour, and we could have continued it; but the man seeing a coach at a distance, wished to stop it, and in doing that, as we had no drags on the wheel, by the back motion, when we were going down at that pace, it kicked, and I said at the time that it was impossible that it could stand it, and we went on for the space of a minute more, and I expect that it did not break, but bent, and afterwards broke.

511. If the tolls had not been imposed, and in consequence of your contract with Mr. Gurney you had started this steam carriage on the Worthing road, and had run for one year only, what do you think would have been the amount of Mr. Gurney's profit?—I cannot possibly suppose, without going into calculation. I always entertained an opinion that had the thing gone on, Mr. Gurney must have made a large fortune, even at a farthing a mile; but he started on a high principle, at sixpence a mile, which he never, I think, could have maintained. I wish to keep up the idea that I should not have gone into the thing

thing until I saw the experiment had answered. I do not mean to say that the immediate amount of tolls having been levied on the Worthing road was the reason that I abandoned my contract with Mr. Gurney; the tolls produced a panic at the manufactory, and the thing seemed to be abandoned. Whether it was for that reason only, I do not know. Mr. Gurney, Sir Charles Dance, and Mr. Hanning were the parties finding means for the manufacture.

512. As your opinion would have depended a good deal on Sir Charles Dance, and he is as sanguine as ever, you have no reason to doubt of its practicability?—I think not. I think it only wants fair play to come to important practical benefit.

513. Do you think the most profitable part of Mr. Gurney's contract with you was this mileage duty, and not the premium you gave of 600*l.*?—The 600*l.* was not a premium; it was a security for the monopoly of those roads; it was to engage this road to myself.

514. Was he to build your carriage for that sum?—No; my impression was that that 600*l.* was to be returned again, either in the shape of the carriage, or in the mileage; it was to secure to me the monopoly of that road.

515. Do you think that was the most valuable part of the contract of Mr. Gurney?—No; that was a mere consideration for the binding of our contract.

516. The most profitable part for Mr. Gurney would be the mileage?—Yes; I think that he would have made the most money by mileage.

Mr. George Henry Ellis, called in; and Examined.

517. WILL you be good enough to state your occupation?—I am an attorney.

Mr. G. H. Ellis.

518. Have you ever had any connexion with Mr. Hanning?—Solely upon one subject, which was upon his buying a share in Mr. Gurney's patent steam carriages.

519. Are you aware of any contract that there was entered into between Mr. Gurney and Mr. Hanning?—One contract, certainly, I recollect, for the purchase of a share.

520. Are you aware of any other contract?—I may say that I have heard him speak of it generally, but I never saw it.

521. Can you speak to Mr. Hanning's signature?—Yes.

522. Is that his signature?—[*The Contract between Mr. Hanning and Mr. Gurney being shown to the Witness.*—Yes; that is Mr. Hanning's hand-writing. I have a memorandum which shows that such an agreement was entered into; it is in Mr. Hanning's own hand-writing. He gave me a list of all the sums of money that he had ever paid in relation to this patent; there being a difference between him and Mr. Gurney as to whether he paid certain sums on account of his purchase or not, he gave me a list of all the items that he paid on any account connected with the patent.

523. What is the amount of that?—Between 4,000*l.* and 5,000*l.*; and the first item of the account, which is in his own hand-writing, is as follows:—“November 26th, 1827: By cheque drawn payable to Mr. Gurney, under a contract for steam coaches to be had of him by the nominees of W. H. on the Western roads, 700*l.* ;” he delivered that to me in his own hand-writing.

524. Was that for the monopoly of running carriages on those roads?—I can only speak upon that point from the recollection of what I have heard him say at different times. He certainly assumed that he had the exclusive right of running coaches upon what he called the Western roads.

525. Had he ever paid any consideration for that monopoly?—I only know from this instruction.

526. You believe that the 700*l.* was paid in consideration of the contract?—I have no doubt of it: he admitted that he had paid that sum, and in such a way that it could not be applied to his purchase of a share in Mr. Gurney's patent, for it was a separate contract.

527. Will you state any of the other items?—I can read the whole. “1828: July 25, ditto, to G. Gurney, 200*l.* September 5th, ditto to Messrs. Cockburn, for Mr. Gurney's use, and which he drew out at his option and use, 500*l.* October 3d, ditto, to Messrs. Cockburn, to pay Mr. Stone my moiety of his patent right, 500*l.* November 14th, ditto, for Mr. Gurney's use, 200*l.* 18th, J. Nash, specially at Mr. Gurney's request, 187*l.* 1*s.* 7*d.* December 1st, 1828, to Mr.

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Gurney, 150*l*. January 10th, 1829, Messrs. Cockburn, for Mr. Gurney's use, 400*l*. February 24th, ditto, 500*l*. March 7th, ditto, 200*l*." Then at the same date, "Mr. Gurney, at his particular request, 200*l*. April 7th, by Stone, draft on me for the second moiety of his patent right agreed to be paid me by the patentees, 500*l*. 11th, Mr. Gurney, 95*l*. 20th, Messrs. Cockburn, 50*l*. 22d, Mr. Gurney, 50*l*. May 12th, ditto, 148*l*. 29th, ditto 100*l*." It amounts to 4,671*l*. 1*s*. 7*d*.

528. Is this a mere running account between Mr. Hanning and Mr. Gurney?—No; Mr. Hanning had bought of Mr. Gurney a certain share of his patent.

529. What share?—I think it was about one-sixth; but I have the agreement. It is to purchase eight and a half parts or shares out of twenty-four.

530. What did he stipulate to pay for that?—He stipulated to pay 6,000*l*.; "and in case the said steam coaches shall be so far brought to perfection as to be used as common stages on any turnpike roads for one whole year, then at the expiration of such year, that the said William Hanning shall give unto the said Goldsworthy Gurney one other bond for the sum of 2,000*l*."

531. That was 8,000*l*. in all?—Yes.

532. Do you know at all what part of that 8,000*l*. Mr. Gurney had received?—It is quite impossible to say. Mr. Hanning paid him sums of money; but Mr. Gurney contended he had not paid these sums on account of his purchase, but in his character of manufacturer. As to a great part of the sums which I read here that they were paid on account of his interest in the manufactory, this was a subject of difference between Mr. Hanning and Mr. Gurney.

533. As far as you have actual information, Mr. Gurney never received from Mr. Hanning any more than the sum named here?—Yes; that was only up to a certain period; there were several sums paid afterwards.

534. Do you recollect what amount?—I should be obliged to speak very vaguely; but I should think Mr. Hanning paid altogether not less than from 6,000*l*. to 10,000*l*.

535. Part of those sums were applied, although exclusively the property of Mr. Hanning, to the use mutually for Mr. Gurney and Mr. Hanning?—Mr. Gurney would not admit that they were his sole property, because that could not be without acknowledging that he had received them on account of the contract for a share in the patents, which he did not do. He claimed a very heavy amount on account of this contract.

536. That sum was to be paid on the then state of the carriages?—Yes.

537. It was to depend upon any improvement?—The 6,000*l*. was certain; the 2,000*l*. was contingent.

538. Mr. Hanning is now dead, is he not?—He is.

539. Did he go on with his contract?—He never completed the purchase of the patent share; he never completed the contract which I have last read, by the purchase of the particular share in Mr. Gurney's patent.

540. Are you at all acquainted with the reasons which induced him not to complete his bargain?—There were several reasons which operated to prevent him from doing so; in the first place, it was not a settled point between Mr. Hanning and Mr. Gurney, for the reasons that I have already stated, that he was entitled to an assignment of the share without the payment of a further sum of money.

541. Can you state any other reason?—Mr. Hanning was a good deal deterred from completing it, by feeling that he could not turn it to advantage without mixing himself up with the actual manufacture of steam carriages, and he did not wish to make himself in any way subject to the Bankrupt Laws.

542. Was it not part of the contract for running upon the Western road, that Mr. Gurney was to build the carriages for him?—I never saw that contract; I only heard Mr. Hanning speak in general terms of it.

543. Were there any other circumstances that prevented Mr. Hanning from going on with the contract?—I think it became a very disagreeable subject to him; he had advanced a great deal of money to enable the patents to go on, and he probably expected that he might be called on for more, unless he withdrew.

544. Do you recollect hearing Mr. Hanning speak in reference to the experiments that were made on the Finchley road?—I have no doubt that I did, but I should not be able to recall the particulars.

545. You

545. You are aware that Mr. Hanning attended those experiments?—He from time to time attended the experiments; I should think there were very few he did not attend.

546. Did you ever hear him give any opinion against the success of those experiments?—No; because he was very sanguine at one time.

547. How long was that before he died?—He died in this spring; I should think not more than four or five years before his death. It was at this earlier stage that these payments were made, and the time at which Mr. Hanning took most interest in these patents was from 1828 to the spring of 1830, after that he was not so sanguine as to their success.

548. Did he give up his good opinion of the success of the carriage, or was it in consequence of any difficulties thrown in the way of running the carriage?

Mr. Hanning was the only monied man in the party, and for every experiment the expense in the end fell upon him, and he was more displeased with having to supply the money than with any thing else.

549. What was his opinion?—I think his opinion was, that it would succeed if there were parties to come forward with money.

550. Did you ever hear him state his opinion as to the great tolls imposed by the local Acts of Parliament?—Yes; he directed my partner to support the prayer of the petition to the House of Commons against one Bill, the Cheltenham Road Bill, which contained a clause enacting very heavy tolls.

551. Do you think that at all operated upon Mr. Hanning, to prevent his concluding his contract?—I think it was one among other causes, and I should say a very strong one.

552. Do you recollect whether immediately before the imposition of these tolls Mr. Hanning was sanguine upon the subject, and whether he changed his opinion immediately after the imposition?—I cannot say that without referring to the dates of particular transactions, but certainly it was in the spring of 1831 that his opinion upon the success of steam carriages had altered.

553. Was Mr. Hanning at all in communication with Sir Charles Dance, upon the subject of steam carriages?—Certainly; I mentioned just now that Mr. Hanning employed my partner to support the prayer of a petition; I believe that was Sir Charles Dance's petition to the House of Commons.

554. Can you speak of the communication between Sir Charles Dance and Mr. Hanning, as to the cause of this stoppage?—Sir Charles Dance came into a share of this patent by purchase from a former patentee, General Viney; the communications of which I am aware chiefly regarded the arrangements that were made between them, as jointly interested in the patent, and did not relate to the details or experiments connected with the manufacturing business.

555. Did you yourself ever have any communication with Sir Charles Dance?—Very little; I have had communication with him; I saw him sign the deed of arrangement when he bought his share in the patent.

556. You never heard Mr. Hanning say that he gave it up in consequence of Sir Charles Dance giving up his carriage?—I cannot say that he has not said that, but I do not recollect it.

557. You never had any conversation with Sir Charles Dance upon the subject of steam carriages?—I must have had conversations from being personally acquainted with him; if he met me he spoke to me.

558. Is it your impression that Sir Charles Dance was sanguine in the matter?—Certainly; for he laid out a good deal of money against the advice of his friends in the subject.

559. Have you seen Sir Charles Dance since he gave up running his carriage on the Cheltenham road?—I saw him two or three weeks ago.

560. Is he still as sanguine as ever upon this subject?—He thinks that the carriages will be running upon the roads in England in a very short time.

561. You do not happen to know from him whether he gave up running on the Cheltenham road, on account of the tolls on that road?—I heard him speak more than once of the tolls being too heavy to suffer it to answer.

562. Did you gather from conversation with him that the experiment was likely to answer if the tolls were reduced?—If I understood him rightly, it certainly answered to a certain point; he went off the road in consequence of an accident. The trustees of the road, as I understood from Sir Charles Dance, contrived to put an end to his experiment, by putting a very great depth of granite in particular parts, so that the axle of the carriage broke immediately on coming upon it.

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563. Was it Sir Charles Dance's opinion that the granite was placed there as an obstacle to his carriage?—Yes.

564. Did he withdraw then?—I think, if I recollect, he took that opportunity of withdrawing from the road.

565. Then this obstacle on the part of the public and the imposition of those local tolls were simultaneous?—No; I think without the accident he might have withdrawn, but when the accident did happen, he did not think it worth while to have the carriage repaired. I speak from a general recollection of his reasons.

566. Do you remember Mr. Hanning ever having said any thing as to his withdrawing himself being owing to Sir Charles Dance's carriage being withdrawn?—No; he never actually withdrew himself, but he took no active step in the concern.

567. He did not advance more money?—No.

568. That was subsequent to the accident to Sir Charles Dance's carriage?—I will not say that he did not advance a small sum afterwards, or that he had not made difficulties in advancing any sum before.

569. It is your general impression, from your conversation with Sir Charles Dance, that it was a profitable speculation up to the time of the imposition of these tolls, and of the accident?—No, I should rather say that it would have been, but for the tolls.

570. You consider that it was more a matter of experiment?—Yes, originally, certainly; and he found that the carriage answered and was applicable to the purposes of public running more thoroughly than he had anticipated when he went down; but he found that the amount he had to pay for tolls operated against his acquiring so much profit as he ought to have done, and I believe operated to prevent it being profitable at all.

571. Then you think he had a better opinion of Mr. Gurney's invention at the time that he left the Cheltenham road, than when he first entered upon it?—As to the carriage, I think he had.

572. From your intermixing yourself with these transactions, is it your opinion that Mr. Gurney has been a considerable loser from the obstacles which those tolls placed in the way of his patent?—There is no doubt that he has been a considerable loser by that, if I may assume that the effect of the tolls has been to prevent the parties taking their contracts, upon which I can only speak as to one patentee, who was a client of my own. Certainly that was one serious cause, among others, which prevented him from putting coaches on the Western road.

573. Can you speak of any other contract?—I know very generally that such exist, but I have never seen them, and I do not know the contents of them, or the roads to which they apply.

Mr. Goldsworthy Gurney, called in; and further Examined.

Mr. G. Gurney.

574. FROM the evidence that has been given, it appears that a certain number of local Acts of Parliament were passed which placed great obstacles in the way of the running of your steam carriages; did those local Acts go to such an extent as to operate on all the roads on which your contracts were made?—They went to a great many of the roads, not to all.

575. Was there a panic upon the subject that those local Acts would be extended to any road upon which your carriage was placed?—It was stated that it was the intention on the part of the Legislature to extend the Acts as soon as carriages were established on the various roads.

576. Did not a Committee sit in 1831, with a view of inquiring into this subject, and preventing any further imposition of tolls against steam carriages?—They did; at the instance of my petition, they inquired into the subject, and recommended legislative protection; stating that the tolls were prohibitory on the Acts that had passed; a Bill was brought into the House immediately after for their repeal, and passed the Commons, I believe without an opposition, but was thrown out in the House of Lords. The public considered that the Legislature had refused to repeal the Acts that had passed, and that they were to be held and considered as precedents for Acts to be passed on the turnpike gates, on any road over which the steam carriages were about or should be used. It had the effect of producing a conviction on their minds, that the subject was one that was intended to be opposed by the Legislature.

577. Then,

577. Then, in effect, the Report on steam carriages, from the Committee of the House of Commons in 1831, favourable to steam carriages, and which might have done away with the panic which had arisen, in consequence of the imposition of those tolls, that panic was rather renewed than diminished by the throwing out of the Bill in the House of Lords, which went to do away with those tolls?—Decidedly so; most people first imagined that those Acts had been passed without a clear understanding of the nature of the subject; but when the subject had been investigated for four months, and the Committee had recommended legislative protection to the subject, then, since the Legislature refused, under those circumstances, to repeal the Acts, they were confirmed in the latter opinion; which, added to the fact of the carriages being withdrawn from Gloucester, gave a general unfavourable opinion as to their work in practice. It completely put an end to all further proceedings on my part. I had myself no capital left to expend on the subject at that moment, having expended every farthing in experiments to bring it up to the state of practicability it was then in when running between Gloucester and Cheltenham.

578. Besides those contracts, did Mr. Hanning assign that as a reason for withdrawing from the undertaking?—I recollect well the alarm with which he came to town; I recollect well the conversation that passed between us; I recollect the manner in which a special meeting of patentees was called; and I recollect having sent my brother and my clerk to ascertain what was his intention to do respecting the finishing of the carriages that were ordered by him. His answer was, "It is no use to attempt establishing the subject in the face of the Government, or to lay out a single shilling further, until we see that the Government do not really intend to oppose us. Therefore you must lose no time in petitioning the House, and having the case investigated and inquired into, so as to arrive at the determination on the part of the Legislature."

579. Besides those contracts which have been spoken of, were any negotiations pending at the time when you first became acquainted with the imposition of those tolls?—Several negotiations.

580. Can you produce proofs of those negotiations?—I think it would be difficult at such a distance of time; it is now four years ago.

581. To what extent were those negotiations?—Negotiations more or less extended over the great roads of England and Ireland.

582. Can you speak to the number of the negotiations?—I cannot at this moment; there were negotiations on most of the great roads.

583. Was any reason assigned by the negociators for breaking up the negotiation?—The general impression latterly was, that the tolls would not be repealed.

584. Was that the opinion of the negociators?—Certainly.

585. As written to you?—I do not know that it was written.

586. Communicated to you?—Yes.

Jovis, 10^o die Julii, 1834.

E. S. CAYLEY, ESQUIRE.

IN THE CHAIR.

John Ward, Esq. called in; and Examined.

587. WHAT is your occupation?—I was formerly in the East India service, but now retired. I take great interest in steam, principally for locomotion.

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588. Have you ever had any dealings with Mr. Gurney?—Yes, I had.

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589. Will you explain the nature of those dealings?—I had one contract with him for the Liverpool and Manchester road; I also had a contract with him for the sale of the Scotch patent.

590. Have you the contract?—I have, for both.

591. Have you it with you at present?—No, I have not; it is with my solicitors. I was only summoned this morning.

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592. Do you remember the nature of the contract?—For the one from London to Liverpool, I paid 500*l.*, subject to a mileage duty; I was to pay him the abatement of 25 per cent. upon any charge that he would afterwards make to the public, in consequence of mine being the first contract.

593. Was that 500*l.* in the way of premium, or was it to be reimbursed to you afterwards?—It was to be reimbursed afterwards in the shape of the carriages. By the agreement I was to have a carriage, and I was to pay for the carriages afterwards as I would require them on the road.

594. Had you a specific agreement for the mileage?—Yes, at so much.

595. Then Mr. Gurney's profit was to be in the mileage, and not in the 500*l.* which was paid?—In the mileage.

596. What was the mileage duty?—It was stated first at 6*d.*, but it was afterwards supposed that Mr. Gurney would reduce that mileage. Under this duty I was obliged to pay 4½*d.*

597. Are there any other terms in the contract besides the 500*l.* advance and mileage duty?—No other.

598. Was he to have any profit in the manufacture of the carriages?—I was not wholly compelled to employ Mr. Gurney as the manufacturer; the terms were, if he could supply me as fast as I wanted the carriages, he was to be the manufacturer; in case of any delay, then I had an opportunity of applying to others, but subject to his approval.

599. When did this contract take place?—I think it was in 1825 or 1826; the latter part of 1825, I think; but I am not very clear as to the precise date, it is so long ago.

600. Which of the contracts are you speaking of?—The contract which I am speaking of was in 1825.

601. Was that the purchase of the Scotch patent, or the monopoly of the Liverpool and London road?—It was the monopoly of the London and Liverpool road.

602. That took place so early as 1825 or 1826?—Yes.

603. Were the terms of that contract ever fulfilled?—They were not.

604. For what reason?—Mr. Gurney always gave out to me that the practical difficulties which he had in bringing the invention to perfection were daily removing, and that it would not be so prudent for me to put on a carriage in an imperfect state, in a long line of road, as in a perfect: he went on experimenting from time to time.

605. Was there no agreement when the other contractors should be supplied?—Yes; by a subsequent arrangement the carriages of Sir Charles Dance were to be supplied in the first instance, and also that Mr. Hanning should be supplied with some of his carriages, on an understanding that I should have the preference of the purchase of the Scotch patent. At that time, I thought that the Scotch were as much alive to the invention, more so perhaps than the English were.

606. Then you had a second contract with Mr. Gurney?—Yes, for the Scotch patent.

607. What was the period of the Scotch patent?—That was in 1831.

608. You considered the invention as perfect?—I considered it as perfect.

609. What were the terms of the purchase of the Scotch patent?—I was to have paid 15,000*l.*, in 5,000*l.* instalments.

610. You were to have paid Mr. Gurney 15,000*l.*?—Yes.

611. Was that contract extended afterwards to Liverpool, to join your line of road?—Yes, it was; that was made subsequently at Edinburgh. I was much inclined to follow up my London and Liverpool line to Edinburgh, and I therefore offered Mr. Gurney an extra 2,000*l.* if he would allow me to have that road included in my Scotch patent; that is to say, if I gave him 17,000*l.* that he would throw in the Liverpool and Edinburgh roads.

612. Were the terms of that contract ever fulfilled?—No, they were not.

613. Was the sum of 17,000*l.*, or any part of it ever, paid by you to Mr. Gurney?—No; I was to pay 5,000*l.* in the course of two months after the period that I entered into the agreement.

614. Did you ever pay any part of that?—No.

615. Will you explain the reason why you did not pay it?—I did not pay that 5,000*l.* because of the heavy tolls being put on, which amounted in my opinion to a prohibition.

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616. Upon which of the roads included in your contract were large tolls imposed?—There were as many as seven, eight or nine roads upon my own particular line.

617. Can you name them?—Tolls were imposed on the Prescott road; there was one on the Coventry, which I must pass through in my contract with Mr. Gurney; the St. Alban's was another which I passed through; there was one in particular interfered with me which was between Edinburgh and Glasgow, which was the Bathgate toll; there was one near to London, the Highgate Trust; I do not recollect any other at this moment. They affected me too sensibly on those lines of road, to think of paying a sum of 5,000*l*. I am not sure whether it was six or seven at this period.

618. The roads that you have mentioned are all that you remember at the present moment?—I cannot remember any other just now.

619. Do you think there may be others in addition to those?—The impression upon my mind was, that there were as many as eight or nine, but I do not know how many I have enumerated.

620. Have you ever ascertained whether those Bills that passed the House of Commons passed the House of Lords?—I did not; it was useless following the subject at this period, as I knew they had passed the Commons.

621. Were you sanguine up to that period of the success of those carriages, as to the capability?—Decidedly, and I am at this moment.

622. You have stated that about the year 1826, which was the period of your first contract, you were not sufficiently aware of the success of those carriages?—I had a very strong idea that they would succeed; I had certainly no proof beyond what I had in my own breast, from having seen the experiment that Mr. Gurney made upon the carriage which he exhibited to me before I paid the first money.

623. When did your doubts begin to give way upon the subject?—I never had a doubt.

624. Previously to your entering into a contract for the Scotch patent, you must have become more convinced of the success of those carriages?—Every day, decidedly.

625. What led you to assure yourself of success?—By experiments that Mr. Gurney made upon the carriages; he built several carriages before he built Sir Charles Dance's.

626. Were you a witness of any of those experiments?—Yes, I was.

627. Were you convinced they would succeed?—I was quite satisfied in my own mind.

628. And that there would be profit attending the use of them?—A very large one, I considered.

629. Did your contract take place with Mr. Gurney, previously to Sir Charles Dance's experiment on the Cheltenham road?—About the same time; I think it is three years since.

630. Did your contract take place previously to the experiment of Sir Charles Dance on the Cheltenham road?—I was a long time in negociation with Mr. Gurney and his co-patentees, previously to signing the contract, during which time he was experimenting not only with Sir Charles's carriages, but with many other carriages.

631. Was your non-fulfilment of the contract at all connected with Sir Charles Dance's giving up the running on the Cheltenham and Gloucester road?—Decidedly not.

632. Can you assign any other reason for not fulfilling your contract, than the tolls which the House of Commons were gradually and generally imposing upon private trusts?—My reason for giving it up was, the fear that the tolls would not stop there, but that they would be extended to become a prohibition to the invention.

633. Were you not aware that a Committee sat upon that subject in the year 1832, with a view of putting a stop to the imposition of those tolls?—Not at that period; the Committee did not sit so early in the year.

634. Did you ever hear of a Bill going through the House of Commons, to put a stop to the imposition of those heavy tolls upon steam carriages?—I did not understand that they were to be taken off for certain.

635. You, who had entered so deeply into this invention, had never become acquainted

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acquainted with the fact that the House of Commons had interfered to prevent the imposition of those tolls?—I do not think that they succeeded.

636. Do you know that a general Bill for the relief of those Acts passed the House of Commons, and was thrown out in the House of Lords?—I do.

637. Then did you become acquainted with the fact that the House of Commons had interfered by way of imposing the tolls on heavy carriages?—In the spring of 1831 I requested my agent to write to Mr. Gurney, and to one or two Members that he was acquainted with, upon the subject.

638. Did the imposition of those tolls upon those roads, and not upon all, create upon your mind an impression that they might be imposed upon those roads in which they had not already been imposed?—Decidedly; in fact I had heard that the Government were determined to put a stop to this invention.

639. And this interference of Parliament was the main ground, if not the sole ground, of your not fulfilling your contract with Mr. Gurney?—Yes, decidedly.

640. What portion of the Scotch patent was it that you purchased from Mr. Gurney?—The whole of it.

641. Had you at all contemplated the number of carriages that you were to run in consequence of your contract with Mr. Gurney for the purchase of the Scotch patent, and for the extension of your previous contract with him from London to Edinburgh?—I have made those calculations; but I can hardly now turn back and state the results. I contemplated making a very large fortune.

642. With regard to the number of carriages that would have been requisite for the road?—I contemplated running as many as from 12 to 20 from London to Liverpool.

643. And how many from Liverpool to Edinburgh, and in Scotland?—In Scotland, I contemplated running six immediately upon the great road between Edinburgh and Glasgow; I did not go into calculation beyond that, because I saw that there was a sufficient profit on the whole. It was not my intention to become the contracting manager of these coaches; my object was to sell out and out the patent right; for I had a party who would have given me a very large sum of money for what I was buying for 17,000*l*.

644. Did you enter into a contract with those other parties?—I did not enter into a written contract; but this party was pledged to me by the most respectable House in Edinburgh.

645. Will you have any objection to state the amount of that?—I can have no hesitation to state at this period; I was to have received 32,000*l*. for the patent right in Scotland, by instalments.

646. Were the negotiations pending at the time of these tolls being imposed?—Yes, they were; I directed my agent to write about them.

647. Were those negotiations broken off in consequence of the tolls being imposed?—I refused to comply with the payment of the first instalment.

648. Were the persons with whom you negotiated anxious for the completion of the negotiation?—They were anxious; they would have fulfilled it, if I had pressed it; but I could not think of pressing it when I did not see profit arising myself; in fact I could not have taken upon myself to have paid Mr. Gurney the 5,000*l*. when I was impressed with the idea that I should have gained no profit.

649. Were the parties with whom you negotiated scientific men, or men competent to judge of the nature and success of those steam-carriages?—One or two of them were engineers themselves; they were perfectly convinced of the efficacy and practicability of the engines.

650. And they had seen no reason up to that time to doubt of the success of the experiment?—No, nor do I think that they have up to this period.

651. You have stated that from 12 to 20 carriages would have been required in the first instance to run from London to Liverpool, that six would have been required to run from Edinburgh to Glasgow, in addition to other parts of Scotland?—Yes, there were many other roads.

652. Suppose the whole amount of carriages to have been 30, what do you suppose would have been Mr. Gurney's profit upon that?—It would depend very much upon the mileage that he fixed upon; we were anxious that he should put

put a low mileage duty upon it. The impression upon my mind is, that it would have been a very large fortune to Mr. Gurney if he had fixed twopence per mile.

653. And there were to be 30 carriages, and those carriages run one hundred miles a day?—One hundred and eighty-six, in one instance.

654. Suppose thirty carriages run one hundred miles a day, at sixpence a mile, what would have been the amount of Mr. Gurney's profit in one year?—I made a calculation at the time, and it would have been a very large amount, 27,360*l.*

655. How many years had Mr. Gurney's Scotch patent to run?—I think about seven years.

656. Then Mr. Gurney might reasonably have expected from that contract with you, for those lines of road, this amount that you have there specified as the whole year's profit on thirty carriages?—Yes; I certainly think so; I should think, now I bring to my recollection my first calculation, when I first entered into the agreement, and when I obtained his license, my profit would have been fifty thousand on the Liverpool and Manchester alone.

657. Had you been at all connected in coach business in any way before?—Never.

658. Besides the 17,000*l.*, which you had contracted to give Mr. Gurney for the purchase of his patent in Scotland and elsewhere, he might have expected for thirty carriages that ran upon this road, a hundred and eighty-nine thousand pounds?—Yes; if he continued to charge that mileage.

659. What was the mileage that Mr. Gurney charged in the first instance?—In my agreement it was put at sixpence per mile, but I was to have a re-abatement of twenty-five per cent; there was a provision in that agreement which went to this effect; that if he, at any time, lowered that mileage, I was to have an abatement of twenty-five per cent.; that is, if he let to any other person at twopence per mile, I was to have it at three halfpence, which re-abatement I consider almost a fortune to myself if the thing had gone on.

660. Do you think that twopence a mile would have been a high charge?—I do think it would have been rather high.

661. It was very low compared with the previous charge of sixpence?—Yes, it is certainly; but I considered at that time, and I consider up to this period, that it would have been policy for Mr. Gurney if he had reduced it.

662. That he would have made more profit by doing so?—Yes, it would be a greater inducement to people to have embarked in it.

663. Have you ever had any contract with Mr. Gurney except in relation to this patent?—Never.

664. You are quite satisfied with reference to the profits exceeding the expenses of those steam carriages?—Yes.

665. Upon what do you ground that?—Upon seeing the consumption of fuel, and looking to the thing as much as I could, I was perfectly satisfied myself of using them with success.

666. Having been a witness to the experiments?—Having been a witness to the experiments continually; I watched it very closely.

667. Have you any further information to give to the Committee upon this subject?—I do not think I have any of any consequence.

668. What amount of tolls were laid upon the steam carriages running upon the roads, which you have described as being affected by your contract?—The Highgate, Whetstone, St. Alban's and Coventry tolls amounted to five shillings each; for my two carriages, this would have been at the rate of nearly 1*s.* per mile, taking the length of each trust; and as I contemplated running small posting tugs, it must have been a prohibition. On the Edinburgh line, the Liverpool and Preston was 12*s.* each time of passing. The Liverpool and Preston was charged on the horse power, and would amount to 2*l.* 8*s.* each time of passing. The Bathgate road, between Glasgow and Edinburgh, in the Bill which I saw, amounted I think to 1*l.* 7*s.* each time of passing. The toll is not carried out in the Appendix, now in my hands, to steam carriages with four wheels, which mine must have had.

Mr. Thomas Bailey, called in; and Examined.

669. WHAT is your occupation?—Engineer.

670. How long have you been engineer?—About sixteen years.

Mr. Thomas Bailey.

Mr. *Thomas Bailey.*

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671. Had you ever any connexion with Sir Charles Dance?—Yes.
672. In what respect?—I was principal engineer to Sir Charles Dance.
673. During what period?—For about three years or three years and a half.
674. You were engineer to him during three years?—Yes.
675. At what particular period; can you state the years?—From the time that we went to Gloucester, the first time that I entered into Sir Charles's employ; I cannot state the year.
676. Was it about 1828, 1829 or 1830?—About 1829–1830, I think.
677. Were you there during the time that Sir Charles Dance ran a steam-carriage between Cheltenham and Gloucester?—Yes.
678. Were you his principal engineer during that time?—Yes.
679. Had you the management of the concern?—Not the sole management; the management of the carriages.
680. You had the management of the working part of the carriage?—Yes.
681. Did you travel with the carriage?—Yes.
682. What was your opinion of the carriage when you first went upon the road?—My opinion was, that I thought they would answer the purpose very well indeed.
683. What was your opinion at the time that Sir Charles Dance gave up running upon the road?—I understood, at least it was an impression upon my mind at the time, that it was the tolls being fixed on the road that was the cause of his stopping the carriages.
684. Did Sir Charles Dance meet with any obstruction connected with machinery to prevent his running on the road; was the carriage imperfect?—There was a trifling defect in the boilers that we had to contend with.
685. Will you explain what you mean?—That of a few of the tubes giving way on the road.
686. Where did they give way?—In the shoots of the pipes; they were butted together, and the pipes being weaker than they are in other parts, the seams of the pipes opened through imperfect workmanship.
687. Was it on account of the imperfection of working, or through the imperfection of materials?—The imperfection of materials of which the pipes were made.
688. Was the practical evil of the butt joints, of which the pipes were made, removed, or attempts made to remove that injury; if so, did they succeed, and in what way were the pipes afterwards made?—After that they were overlapped and welded down.
689. Did that succeed?—Yes, that is the way we have them made to this day.
690. How long did those carriages run between Cheltenham and Gloucester?—Four months.
691. Did people travel with them?—Yes.
692. Did they seem to have a confidence in their safety?—Yes, perfect confidence; a little prejudice existed, but all who travelled with them had perfect confidence.
693. Was the prejudice greater at the beginning or the end of the carriage running?—I think it was greater at the beginning.
694. Was it wearing away when you gave up running the carriage?—A great deal.
695. Did any accident happen during the time that you were running?—Not any.
696. Not of any description?—There was one overturning of a gentleman's carriage, but that was on account of a spirited horse that had overturned the carriage previously to our going there, but there was no accident that occurred in any shape or way.
697. Did horses in general drawing or people riding appear to take fright?—Not more than at the ordinary stage coaches.
698. What was the reason, do you suppose, of the carriage being given up, if it succeeded so well?—I understood from Sir Charles, it was the general conversation about us who were concerned about this, that the tolls were the cause.
699. Did you ever hear that from Sir Charles Dance himself?—I never heard him say that personally, but that was the conversation among the men.
700. Can you state whether Sir Charles was as satisfied with it at the end of four months as at the beginning?—Yes, I think he was.

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701. Was he sanguine?—Yes.
702. Did you ever make a calculation of the expense of running the carriage, compared with the expense of running with horses?—No, I never did myself.
703. Did you ever see any estimate made?—Yes, I have seen it in print.
704. Are you a judge of the accuracy of that statement?—Yes.
705. What was the result of that estimate?—I think it was drawn up very fairly, at a less rate than what the horse coaches could possibly perform the journey.
706. Was your impression that a profit was made upon running the carriage between Cheltenham and Gloucester?—Not at that time.
707. Why was there no profit to be made?—Because I consider that the traffic between the two towns was not sufficient to support it.
708. How many generally went with you on the journey?—Sometimes we have had three and four, and sometimes more than twenty.
709. Did not the carriage generally fill?—Not generally.
710. Do you think it would have filled if the public had gone on increasing in confidence, as they had done during the time that the carriage ran?—Yes.
711. Did Sir Charles Dance find any fault with the carriage when it broke down; did he blame the workmanship of the carriage?—No.
712. He did not make any observation upon that?—No, he did not.
713. Do you remember a carriage being broken on account of the quantity of metal lying on the road?—Yes, I was with it at the time.
714. Was that in consequence of any deficiency in the carriage?—No.
715. What was the cause of the breaking of the carriage?—The immense quantity of stones that were laid on the road.
716. Was it an unusual quantity?—Yes.
717. Did it break any other carriages?—There were several other carriages brought up on those stones that they laid down.
718. Could those carriages run over the stones?—Not run over; they got over by extra horses; the passengers were obliged to alight from the coaches.
719. Did the steam carriage run over the stones more than once, before the carriage was broken?—Twice, and the third time the axle was broken.
720. In what way; were the stones in larger quantities than usual; were they heaped?—Yes; I should think that they were laid as much as 15 inches thick.
721. Have you any reason to suppose that they were laid there to obstruct the steam carriage?—Yes.
722. What reason have you?—Because it was an unusual quantity; and they did not lay any stones till they had this quantity prepared near a spot where they laid them, and by the remarks that were made by the men who were breaking the stones, previous to their laying them down.
723. Was that part of the road in a bad state of repair, previously to the stones being laid?—No; as good as any other part of the road.
724. Was the carriage mended after the breaking?—Yes; the axle-tree was mended after the breaking.
725. Was the carriage ever run afterwards?—No; not on that road.
726. Why?—I understood at the time that the tolls would be to the amount of 11s. or 12s. each time, for running from Gloucester to Cheltenham and back; I think that was the primary cause of the stoppage.
727. Do you remain engineer with Sir Charles Dance?—No; I am at Mr. Maudsley's.
728. Have you any connexion with Sir Charles Dance?—I am retained there at his request.
729. Is Sir Charles Dance a practical engineer himself?—No, not a practical engineer.
730. He consults the men he employs?—Yes.
731. Have you been lately considering the question of these steam carriages?—Yes.
732. How lately?—I am employed continually now at Mr. Maudsley's.
733. In consequence of your applying yourself continuously to the subject of those steam carriages, is it your opinion that there is less reason to suppose that success will attend those steam carriages, than you had when you first began to consider the subject?—No.
734. You still are sanguine as to the success of those carriages?—Yes.

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735. And that the carriages would now be running if it had not been for the imposition of these tolls?—Yes, I think they would.

736. Were you conductor of the carriage that was to go to Birmingham?—Yes, on the journey.

737. Was that the same boiler which was used at Gloucester?—No; that was not the same boiler.

738. What was the difference between that boiler and the boiler that was used at Gloucester?—The separator was taken away.

739. When did this experiment take place to Birmingham?—At the latter end of last year.

740. Do you consider the separator an important part of the boiler?—I think it is myself an important part.

741. Do you consider the failure of Sir Charles Dance's experiment to Birmingham, as a failure of Mr. Gurney's invention?—No, not at all.

742. You consider it as an improvement in Sir Charles Dance's mind, upon Mr. Gurney's invention?—Yes.

743. You have seen the printed journal?—Yes.

744. Is it correct; have you compared it with your notes?—Yes.

745. Have you seen a letter from Mr. Stone in that pamphlet?—Yes.

746. Do you know this to be correct?—Yes; I corresponded with Mr. Stone.

747. Do you consider the experiments that you have seen since you have left Mr. Gurney's service, to be improvements upon the carriage as made by him?—No, I do not.

748. Has the plan adopted there been retained by other engineers who have succeeded, previous to the stoppage at Gloucester, such as the arrangement of the general machinery?—There has been a difference; but I think the major part of them is what I should call a copy of the carriage.

749. The general apparatus and arrangement of the machinery, and so on, are the same as Mr. Gurney laid down?—Yes.

750. And that is found to succeed?—Yes.

751. And that has been adopted by your present employers, to a certain extent?—I know not what may come out of the manufacture now; I think that will be on a different plan to what the others are.

752. Do you conceive that the carriage has received any material improvement, since Mr. Gurney had any thing to do with it?—No, it has not.

753. You think at the same time that the carriage is perfectly practicable, and would be profitable to run, if the tolls were not imposed?—Yes.

754. You think the credit of the carriage, under these circumstances, is due to Mr. Gurney?—Yes.

Mr. David Dady, again called in; and further Examined.

Mr. David Dady.

755. ARE you acquainted at all with the weekly expenses of Mr. Gurney's manufactory?—Yes.

756. During what period?—From the year 1825 to the spring of 1832.

757. What were the weekly expenses during that time?—They were sometimes more than others; some weeks, at the highest, they were 100*l.*, and sometimes they were down as low as between 30*l.* or 40*l.*

758. At what period was the greatest expense going on?—I think it must be in 1828, and from that to 1831.

759. Can you at all speak as to the total amount of your weekly expenses during those years?—I think the sum total was about, from a rough calculation that I made at the end of the year 1830, 16,000*l.* or 17,000*l.*

760. Does that include the item of materials with the wages?—Yes.

761. Have you looked over your books lately so as to refresh your memory?—I have looked over the accounts yesterday, and see that they are about that.

762. What proportion would there be of materials to the wages?—The wages would be half, or more than that.

763. Can you at all speak as to the weekly wages after the contracts were entered into with Mr. Gurney by Mr. Hanning and others, about the year 1830 and 1831?—I think the weekly wages might have been 40*l.* and sometimes 50*l.* at that time.

764. Do you recollect Mr. Gurney's first experiment; were you then with Mr. Gurney; at what time were you first in Mr. Gurney's employ?—In 1824.

765. Did

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Mr. David Dady.

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765. Did you make an experiment with him in locomotive carriages?—It was in 1824 that I made an experiment at Kilburn with him.

766. Was that a model carriage?—It was.

767. Did that go upon the road?—Yes.

768. And up a hill?—Yes, up through the turnpike gate.

769. Do you know of any experiments that had previously taken place?—I do not know of any.

770. What was the general opinion in regard to the running of steam carriages, according to the best of your opinion?—I am not able to answer that. I never heard of any running before.

771. What was the rent of the premises?—The rent was upwards of 700*l*.

772. What were the rent and taxes?—The rent and taxes amounted to nearly 1,000*l*.

773. Is that calculated in your estimate of 16,000*l*?—Yes, the rent is included; it is only a rough estimation.

774. Is the wear and tear of the machinery in that calculation?—That with what we have expended in repairs when they were necessary.

775. Do you know what was given for the factory and the tools and apparatus to fit it up?—I do not recollect exactly; but I think about 3,000*l*. or 4,000*l*.

776. Do you recollect the estimates that were taken of it a short time before the factory was closed?—I recollect Mr. Stone taking an inventory and making an estimate.

777. Do you recollect what his value was of the fixtures?—No, I do not; but I think they were a considerable deal more than they were when they were purchased.

778. You do not recollect what?—It amounted to as much as 8,000*l*.; but I do not remember exactly.

779. Do you recollect what all those tools were sold for when the factory closed?—No, I do not.

780. Have you no idea?—No, I have not.

781. Do you recollect the carriage going up Highgate Hill?—Yes.

782. Did you ever measure the elevation of that road?—I never measured it; but I heard those that measured it say that it rose in some places one in eight and one in twelve.

783. Did that change your opinion at all as to the carriage, or the opinion of those who saw it?—My impression was, that there was now no doubt that the carriage could be made to go up every hill in England.

Alexander Gordon, Esq. called in; and Examined.

784. WHAT is your occupation?—A civil engineer.

A. Gordon, Esq.

785. Are you acquainted particularly with the subject of steam carriages?—I have been looking minutely into the subject for nearly ten years.

786. Have you ever published on the subject?—Yes, I have published two works.

787. What is the date of the first?—It is dated, I believe, in 1832; it is shortly after the report of the Select Committee upon steam carriages.

788. Have you had any practical experience of those steam carriages?—I have been very repeatedly allowed the walk of several factories, where the proprietors were constructing steam carriages. Some of those steam carriages never succeeded, others of them did succeed. I have travelled by different steam carriages, I think, a distance, when added together, of nearly 2,800 miles. I have taken a particular interest in the subject.

789. Had you any communications with Sir Charles Dance, during the time that he was making his experiments?—I cannot say that I had communications with him, relative to steam conveyance, at the time he was making his experiments for Gloucester. I had been twice at Sir Charles' residence, near London, before he went to Gloucester; but I was not acquainted with him sufficiently to talk on the subject until after he was settled at Gloucester.

790. Had you a conversation with him after he was settled at Gloucester?—Several conversations.

791. Have you any objection to state to the Committee the nature of those communications?—I cannot say that I can detail any communications.

792. Had any of them reference to the cause of the stoppage of the carriage on the Gloucester and Cheltenham road?—Sir Charles was certainly very much

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disappointed at the opposition which he met with there, and he himself attributed it to the opposition of the land owners, and to the opposition of the road trustees; he particularly alluded to the tolls which had been imposed on steam carriages, whereby very heavy charges were to be made each time a carriage went through certain gates.

793. From your impression of your conversation with Sir Charles Dance, do you believe that he would have continued running his carriage on the Cheltenham and Gloucester road, if those tolls had not been imposed?—Judging from Sir Charles Dance's determination, he would have continued, if it had not been for these tolls.

794. Did you hear from him whether he considered it a profitable speculation?—I never heard him talk on that part of the subject; if he had done so, I should have met him immediately with the observation, that he had too expensive an establishment ever to make so short a line a profitable one; he took that line, I believe, with a view of extending it to Bristol.

795. Then it was by way of experiment that he took that?—That line was the beginning of a greater undertaking.

796. As far as you know of that experiment, do you conceive it to have answered?—I have seen the manuscript account kept by Sir Charles Dance's engineer of a number of trips, and of the time occupied in accomplishing those trips, and I consider it a very good table of facts.

797. Taking profit into account?—Where the returns have been stated; but I have not been furnished with all the data, for making a profit and loss account.

798. Are you aware of any serious improvement that has been made in steam carriages, since the date of that carriage?—Except in the mode of putting them together, and in the advantage of better tools, I do not see any improvement; of course there are improvements in workmanship, which must go on as the subject advances.

799. But nothing in point of principle?—No; indeed I think if a steam carriage was to be constructed now, the same principles should be followed, or very nearly so.

800. From your having turned your attention so much to these subjects, you are aware, whether you consider Mr. Gurney as the practical inventor of a steam carriage, which is capable of going, or not?—I believe it is the opinion of all other engineers as well as of myself, that the subject was altogether *in nubibus* till Mr. Gurney took it up. He practically illustrated the practicability of propelling by adhesion of wheels to the surface of the road, and showed that the scientific world had been proceeding upon fallacious notions up to that time.

801. Do you conceive that the impression was so strong upon the mind of engineers of the incapacity of the wheels to propel the steam carriage, that unless Mr. Gurney or some other person had made this discovery, no attention would have been bestowed on the subject at this time?—At the time that Mr. Gurney proved the practicability of moving by adhesion of the wheel to the road, there were several plans proposed for propelling by other means, and it was thoroughly believed by engineers, that it was impossible to ascend a hill by adhesion of the wheel to the ground.

802. You have stated that it is the opinion of engineers that Mr. Gurney's steam carriage has proved practicable as a mode of travelling upon roads?—Yes; in the month of November I was requested by Mr. Telford, Mr. Cubitt, Mr. Field, Mr. Donkin, Mr. Timothy Bramah, Mr. Macneill, Mr. Simpson, and several other scientific gentlemen, to arrange for an experimental trip, with a steam carriage, to Birmingham, and I accompanied them; the result was not so satisfactory as we could have wished, so far as speed is to be considered; but it convinced them, and they signed a Report accordingly, that they believed the thing was now practicable; there were several other engineers upon that trip; there was Colonel Paisley, of the Royal Engineers. This took place in November last.

803. Was that carriage fitted up with a boiler of Mr. Gurney's construction?—That carriage was fitted up with a modification of Mr. Gurney's boiler, but it was not an efficient modification, because one of the principal points which Mr. Gurney had turned his attention to had been neglected, that is, separation. As I had taken the management of the stations for supplying coke and water,

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I, of course, took a little interest at the filling of the tanks when we came to the stations, and I was surprised to see the immense quantity of water we had evaporated, or which we appeared to have evaporated, and in looking over my notes shortly afterwards, I was the more convinced that we were not evaporating fairly, that we were blowing water along with the steam through the cylinders of the engines, and thus making the great demand which we had for water.

804. Did you burn the pipes ultimately?—We had a defective pipe before we got five miles out of town, and another defective pipe at Stony Stratford, 51 miles.

805. Did you attribute the defect to their being heated?—I think they must have been heated, when left partially dry, from the water being in a frothy state.

806. If the carriage had been completed, according to Mr. Gurney's principles, do you conceive that this failure would have taken place?—If Mr. Gurney's principle of separation had been adhered to, this would not have taken place; I think, indeed I may say with certainty, that we should have arrived in Birmingham in very good time.

807. What is the opinion of those engineers you have mentioned, and of yourself, as far as you are able to tell them, of the causes for which Mr. Gurney's carriage has not come into full operation before this time?—I can scarcely answer that question without reflecting a little; engineers have thrown cold water upon the subject till very lately; indeed until this trip in November. The principal engineers seem to have considered it a very doubtful matter whether a steam carriage could go at all; they seem to have doubted whether the practical difficulties were overcome. Opinions which I have just expressed as to the persuasion of other people, all go to show that there was an impression abroad that prohibitory tolls and other moral difficulties were thrown in the way of steam carriages, and that they could not then be proceeded with.

808. What do you mean by moral difficulties?—Impressions had gone abroad amongst the landed interest, that it was contrary to their advantage that the steam carriages should be introduced, and amongst road trustees also, who are of course immediately connected with land and with agricultural pursuits; and these altogether combined to form a very serious opposition to the introduction of steam carriages on turnpike roads.

809. What do you think is the public impression as to the cause of these stoppages?—Those gentlemen with whom I have conversed upon the subject, and who have taken some interest to make themselves acquainted with it, seem all to be of opinion that the heavy tolls which were imposed were very much against the subject; indeed it was notorious at the time, I may use that word, it was notorious that Mr. Gurney's carriages, the property of Sir Charles Dance, were stopped at Gloucester in consequence of those prohibitory tolls.

810. You are aware that a great number of roads in the kingdom were not affected by those tolls; are you of opinion that it had this kind of moral effect, that the Legislature were setting their faces against the thing generally, and that that gave an impression that the thing would not ultimately succeed?—I think so; the feeling got abroad amongst road trustees and was more strongly exhibited afterwards, for I have seen toll-gates shut upon us. I went on one occasion to ask the secretary of Waterloo Bridge if he would give permission to take up passengers upon the bridge, and he at that time said that he did not think his directors would be inclined to entertain the subject at all, or even to allow the carriage to run on the bridge.

811. Then you think the stoppage regarded as much the roads on which there were no tolls as those in which tolls existed?—Yes; there was a fear abroad they would be stopped by tolls at a future time.

812. Was that impression upon the public, in your opinion, sufficient to account for the sudden suspension of Mr. Gurney's manufactory and pursuit of the subject?—It fully accounts for it to my mind. I had conversations with two or three gentlemen upon the subject; one gentleman in particular I was very often with; his object was then to run steam carriages fifty miles out of London and back again, and to continue to run Mr. Gurney's carriages as a trade. I know he gave it up immediately after this, and attributed it at the time to the imposition of those tolls, and the impression which they had created.

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813. Had he been sanguine as to the success of the carriages up to that time?
—Very.

814. This was a negotiation at the time immediately preceding the imposition of those tolls, and that negotiation was put an end to by the imposition of those tolls?—Yes.

815. Do you know of any other negotiation that was going on at that time?—There was a good deal of interest taken in the subject by gentlemen of money in the city; but I am not prepared to state any thing more so positively as what I have stated in this particular case.

816. Was the feeling of the public mind beginning to re-act upon the subject, and to become more favourable to those carriages at that time?—At the time the carriages were running, the public mind was disposed to entertain the subject. It was favourably disposed.

817. Did the public mind undergo a change at any particular period?—Immediately after the suspension of Sir Charles's carriages.

818. And the suspension of Sir Charles Dance's carriages being attributable to the tolls?—Yes; at least I may be allowed to take Sir Charles's own impression, because I saw a manuscript letter from Sir Charles to that effect, where he attributes his stoppage mainly to this cause. I went with Sir Charles one night to the Institution of Civil Engineers, and introduced him there. The chairman (Mr. Telford) called upon him to state any thing he had to state upon those steam carriages, and Sir Charles then told them that the stoppage of his steam carriages was on account of the tolls that were imposed, not upon that road particularly, but upon various roads; in short, that whilst he was encouraged by the poor people of the community, the road trustees and land-owners had taken these as well as other means to crush him.

819. Did Sir Charles Dance state that publicly to the Society of Engineers?—Yes.

820. Did he state any other reasons why he had not gone on with his experiment at Cheltenham?—Nothing of a financial nature.

821. Have you ever yourself published this fact before?—In some lectures which I delivered more than twelve months ago at some of the institutions in London, the Mechanics' Institution, the London Institution, and the City of London Literary and Scientific Institution; at all of which I attributed the stoppage of the carriages entirely to the imposition of the heavy tolls in many local trusts.

822. Do you conceive yourself borne out by the observations of Sir Charles Dance in making that assertion?—I certainly would not have stated it publicly without being very strongly persuaded of it.

823. Is it your opinion, as an engineer, that Mr. Gurney's steam carriage is safe and practicable, and would be profitable, provided no legal impediments were placed in the way in the shape of heavy tolls?—I have given the subject so much attention, and have watched the progress of so many carriages minutely, that I think I may safely venture to say, that it will be a safer mode of conveyance than any horse conveyance; that Mr. Gurney's boiler, properly made (even if an accident should happen to it), will not be attended by any loss of life; that it is much more manageable than any horse conveyance can be; and that it will be a very profitable speculation.

824. You think that the machinery is in a state that will be durable; the boiler and the other machinery, are they now brought to such perfection as to be durable to any considerable extent?—When I am asked if they are now brought to such a state of perfection, I cannot well answer, because I do not think that there has been any improvement upon Mr. Gurney's carriages, as he furnished them at the time his manufactory was in operation.

825. During the year 1831?—Yes.

826. You consider his invention at that time as sufficiently perfect for practice?—I do not mean to say that Mr. Gurney had employed the best tools and the best workmen; I think if Mr. Gurney's views had been acted upon in some of our good manufactories, a very different and superior machine would have made its appearance.

827. You do not think that the deficiency in Mr. Gurney's steam carriages was in the want of a proper principle to apply to them, but the want of a capital sufficient to set them agoing?—Decidedly. Good tools are requisite, and there

there is a sort of apprenticeship that even good workmen must go through, before they are brought to manufacture very accurately; but Mr. Gurney was rapidly overcoming these desiderata.

828. Is it your opinion, that if the capitalists who were at the time contracting with Mr. Gurney for the use of this carriage had not been impeded by those heavy tolls, Mr. Gurney's carriages at this time would have been both practicable and in general operation, and would have been paying a high profit to Mr. Gurney?—My impression is, that upon the road to which I have alluded, and upon several other roads, they would now have been in profitable operation, both to speculators in the carrying trade, and also to Mr. Gurney, the patentee, by necessary consequence.

829. Is it your opinion, that the credit due to this invention is mainly or entirely due to Mr. Gurney?—I have not the least hesitation, and I do not suppose that there is any man who knows any thing on the subject, who would have any hesitation in saying, Mr. Gurney is the person who gave it birth, and brought it into a practical state.

830. Can you state it as a fact, that it is the opinion of practical engineers, and the first engineers of the day, that Mr. Gurney is the first inventor?—Yes.

831. Whom?—I have talked with several.

832. Is it your opinion that what Mr. Gurney has done has led to the creation of those carriages that are now running?—It has given birth to them all; they have been successful (and I must state it strongly) just in proportion as they have followed the principles which Mr. Gurney found it necessary to introduce.

833. Do you conceive that they are trenching upon Mr. Gurney's patent?—I have seen a carriage that does trench upon his principles; and I have ridden by it.

834. What carriage is that?—I should rather not answer the question, if the Committee will not press it. In this carriage, to which I allude, the principal defect is in the boiler's not having a good circulation. The owner has got a circulation upon Mr. Gurney's principle, and he has lately introduced a larger separator to his boiler, in order to come near to Mr. Gurney's other principle; for there were two principles acted on by Mr. Gurney, separation and circulation.

835. Do you suppose that the object of the proprietor of this steam engine is to go as near the wind as he can to Mr. Gurney's principle without invading it?—I do not say what his object has been, but he has done so. With regard to that boiler, and with regard to Mr. Hancock's and other boilers, I would state that they are defective, because they have not adhered closely enough to the rules which Mr. Gurney acted upon. They have blown the water in a frothy state into the upper part of the boiler, leaving the lower part dry.

836. In consequence of those boilers being blown dry at the bottom, were they subject to burn the tubes?—That is the necessary consequence.

837. Do you conceive that they followed this plan because they did not approve of Mr. Gurney's principle, or for fear of invading his principle?—They would not invade his patent; but whether they were perfectly aware of the necessity of having a good circulation and a good separation I do not know. I should think some of them are not aware of the importance of these points. I think this subject is one upon which engineers are particularly ignorant. There was a case mentioned in the Institution of Engineers, and which I made public about two years ago, of two boilers fitted up for the same engine, and of the same size; one of them had been at work nine years, and the other boiler was burnt out in three weeks after it was put to work upon an extensive boiler-maker's premises. Although separation appears to have been good in that case, circulation was far from being so.

838. Are there any other boilers, of which the drawings are now before you, in use at this moment, or attempted to be introduced?—Mr. Hancock's is now being extensively used. I do not know that that has any approximation to Mr. Gurney's principle; the defect in the boiler is, it has not the same safety as Mr. Gurney's. In fact, Mr. Hancock's boiler has been attended by one lamentable accident; a man was killed, who was close at work beside it, and there seemed to be a very great difficulty in accounting for the accident; but it is entirely to be attributed, in my opinion, to water having been blown up to the surface, and being unable to escape through the safety valves with the same

rapidity

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rapidity that steam would, the lower part of the boiler being at the same time burnt by its exposure to the intense fire. There is this modification of Mr. Gurney's boiler, on the drawing before me, now being introduced by Mr. Field. I call it a modification, because I think it is Mr. Gurney's boiler modified. It was with this that the party of engineers and I went down to Stony Stratford in November last.

839. Have you heard of a proposition of running to Birmingham by this carriage now building?—I believe it will run to Birmingham.

840. Do you, in your opinion, conceive, if the carriage should break down, Mr. Gurney's carriage or the principle of his patent is in any way likely to be affected by it?—The subject will be affected by it; but I do not see that Mr. Gurney's principles are involved in it; for the builder is only availing himself of *circulation*; his *separation* is very imperfect. It may, however, be disadvantageous to the general subject.

841. It cannot be said that Mr. Gurney's principles have failed?—Those who are not acquainted with Mr. Gurney's principles may say so; but those who understand the laws affecting water when under high degrees of temperature, and how Mr. Gurney conformed to these laws, cannot say so.

Veneris, 11^o die Julii, 1834.

E. S. CAYLEY, ESQUIRE,

IN THE CHAIR.

Charles A. Thiselton, Esq. called in; and Examined.

C.A. Thiselton, Esq.

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842. HAVE you read this document?—I have.

843. Is it your hand-writing?—It is.

844. What is the document?—It is the minute of the proceedings of the four co-patentees and Mr. Gurney. On that occasion I appear to have taken the minutes; it is drawn up in my hand-writing.

845. Have you seen this paper since?—I have not seen it till this morning.

846. Have you seen this signature of Mr. Ward?—I have.

847. Is this in Mr. Ward's hand-writing?—Yes, signed in my presence.

848. Mr. Ward who purchased the Scotch patent?—Yes.

[The Witness delivered in the same, which was read, as follows:]

January 3, 131.

Present:

G. Gurney, Esq.

Sir Charles Dance.

Mr. Hanning, for Dr. Mackie.

Mr. Thistelton.

IT was mutually agreed between the above Patentees, and on behalf of Mr. Hanning, (absent) That the several preliminary agreements heretofore made between the said parties for the sale and purchase of the patent rights in Scotland should be altogether rescinded, and that the following be the provisional arrangement for that purpose: viz.

That Mr. Ward, within six weeks from the date of Sir Charles Dance commencing the running of his carriages on the public roads between Gloucester and Cheltenham, shall sign a contract for the purchase of the Scotch patents, paying down at that time the sum of 5,000*l.* (Five thousand Pounds); a further sum of 5,000*l.* (Five thousand Pounds) within three months from the date of signing the aforesaid contract; and the further sum of 5,000*l.* (Five thousand Pounds) at the expiration of nine months from the date of the contract. The two latter instalments of 5,000*l.* each to be satisfactorily guaranteed to the patentee by parties of known respectability.

Golds. Gurney.

C. W. Dance.

Patrick Mackie, by his Attorney.

Chas. Hanning.

Chas. A. Thiselton.

I AGREE to accept the before-mentioned arrangement.

H. Macleod, Witness.

John Ward.

849. Was Mr. Gurney appointed by the patentees to go down to Scotland to examine the references of Mr. Ward?—He was.

850. Was

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850. Was he empowered to make any new arrangements there in case he thought it necessary or desirable?—Yes; at full meeting of the patentees, he was requested to go and enter into any contracts; and full powers were given to him to enter into any arrangements for our benefit.

851. Did Mr. Gurney, on his return, state that he had made another arrangement?—Yes, by which an additional road was granted him to join with his previous road contracted for from Liverpool and Manchester to London; namely, from the Liverpool and Manchester end into Scotland and Edinburgh. I remember Mr. Gurney reporting the foregoing contract to his co-patentees upon his return, and producing the agreement.

852. Do you know the hand-writing of the other patentees who signed that document?—Yes.

853. Are you a patentee yourself?—Yes; and my signature is to that paper; it was signed by all the patentees, with the exception of Mr. Hanning, who was not present at that meeting.

854. Were there any sums of money advanced by Mr. Gurney which were to be paid back out of the first proceeds of the patent?—Yes, there were various sums advanced by Mr. Gurney from his own private funds, which it was understood by the co-patentees, were to be reimbursed to him out of the first profits before myself or the other co-patentees were to derive any advantage.

855. Do you remember the amount of those sums?—I cannot at this time; but I think I could trace it; but they were considerable.

856. Was it as much as 4,000*l.* or 5,000*l.*?—My impression is that it exceeds it.

857. Then before the patentees could derive any benefit from the patent, Mr. Gurney must be reimbursed in 6,000*l.* or 7,000*l.*?—Yes, that was the understanding; Mr. Gurney had advanced private sums which the other patentees should have in justice contributed *pro rata*; and it was admitted that it would be just that that sum should be reimbursed to Mr. Gurney out of the first profits.

858. You can speak to that being the understanding of the other patentees?—Yes.

Michael Farraday, Esq. D.C.L., called in; and Examined.

859. ARE you professor of chemistry at the Royal Institution?—The Fullerian professor there; Mr. Brand is the professor.

*M. Farraday, Esq.
D.C.L.*

860. Are you member of the French Institute?—I am.

861. Can you speak as to the originality of the invention of Mr. Gurney's steam carriage?—It is the first that I ever heard or read of.

862. With success?—I have not attended to its practical success; I am speaking to the actual opinions that I have obtained in the way of reading or conversation.

863. You are not aware that any steam carriage was ever built which approached the practicability of running upon common roads before?—No, I am not.

864. Was it a topic of conversation among members of the Royal Society at that time?—The conversation I am speaking of was rather with members of the Royal Institution.

865. Can you state the nature of those conversations?—At the time when we first heard of Mr. Gurney's proposition to make steam-carriages run upon ordinary roads, most scientific men were of opinion that it would be impracticable; that the wheels would not hold upon the roads. My recollection of Mr. Gurney's being the first carriage, depends upon having asserted at that time that it would be practicable in that respect; that there could be no objection, in that point of view, to it; with respect to the wheels laying hold, if I may say so, of the road; and that its failure must depend upon other points than that, if it failed at all; there being at the time a general objection to it on this head.

866. Did any other objections occur to you at that time?—Not objections; I am in the habit of reserving my judgment till I see propositions put in a practicable form; and so far as that goes, it is an objection, but no other than that.

M. Farraday, Esq.
D.C.L.

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867. Have you ever seen those carriages in practical operation?—Yes; I have seen other steam carriages running.

868. Can you state what is the opinion of the learned upon this matter; you stated the opinion before, was a doubt as to the success; can you state what the opinion has gradually been since the last settlement of this point?—My opinion is, that the public opinion has been changing in favour of it; but whether scientific men are all of opinion that it will ultimately succeed or not, I cannot say.

869. Have you had any conversation with members of foreign learned societies upon this subject?—No, I have not.

870. If there had been any carriages of this kind started in foreign countries, it would have come within your cognizance?—I should have heard or read of it, I think.

871. Had you any conversation with Dr. Wollaston respecting this carriage?—No, I have not.

872. Do you happen to know any thing of the invention of Mr. Hancock?—I believe he invented one; I saw it standing still upon the Kilburn road; something had given way, and I saw it at that time.

873. Is he considered to divide the merit with Mr. Gurney upon those steam carriages?—My mind has not been sufficiently directed to the progress of this subject; it has been taken away by other subjects.

874. Would you say the tubular boiler, as a scientific man, would be a stronger and less dangerous one than the other species of boilers?—The smaller the tubes the greater the power they can resist; there is no doubt about it; the stronger, clearly as regards any given pressure to be obtained within them.

875. And if they burst, what would be the degree of the danger?—There must of necessity be far less danger with them than with the mere plate boilers.

876. If that portion of the boiler which is constantly exposed to the fire were continually filled with water, would it be likely to last longer than if it be exposed to the fire without water, and having merely steam in it?—I think so, certainly.

877. Are you aware that Mr. Gurney's boiler has what he terms a separator, which allows the steam to escape, and always keeps the water in the tubes which are exposed to the fire?—No; I am aware of the particular description of the boiler.

878. You cannot speak as to the difference of construction between Mr. Hancock's and Mr. Gurney's?—No, I cannot.

The Rev. *Dionysius Lardner*, LL.D., called in; and Examined.

Rev. D. Lardner,
LL.D.

879. CAN you speak as to the originality of Mr. Gurney's invention of a steam carriage to run on common roads?—Yes; the originality lies in the boiler, I believe, chiefly. It is the first of the kind which was used; Mr. Gurney's was the first steam carriage for turnpike roads of any kind, which I know of.

880. Was there any other attempt before that time to run steam carriages on common roads?—Trevithick, when he first contrived steam engines for railways in 1804, contemplated in his original patent, if I recollect rightly, the project of running the carriage which he had constructed upon a turnpike road. I believe however that he never tried it, or if he did, failed. It never was afterwards used to my knowledge, except on railways, nor did he ever recur to his idea of trying it on roads again.

881. Are you aware that he himself considered his experiment as a failure?—I believe he did.

882. Is it your opinion then that Mr. Gurney was the first person who brought steam carriages to run on common roads to a practical bearing?—Decidedly, I entertain no doubt about it.

883. Then you think there is no other to divide the credit with him?—Not antecedent to his first introduction of the project; after, however, he had exhibited a successful experiment, and accomplished a long journey on turnpike roads in his steam carriage, a great deal of public attention was excited, and, as might be expected, a great number of speculators took the field. All sorts

of

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of changes were rung upon Mr. Gurney's ideas, and a great number of experimental steam carriages have been exhibited with more or less success.

884. Do you think any of them better than Mr. Gurney's?—As far as I know, they are not; but I do not profess to have acquaintance with them all; I know several of them, and am acquainted with their structure, and have been on some of them working.

885. Will you state the peculiarities of Mr. Gurney's boiler?—All boilers intended to impel steam carriages on turnpike roads should be, 1, small in magnitude; 2, light in weight; 3, strong to resist severe pressure; 4, capable of producing steam with great rapidity. These I think are the principal requisites. In Mr. Gurney's boiler the water is contained in a great number of small tubes and in strong iron cylinders; the tubes are exposed to the immediate action of the fire; thus a great number of threads of water are exposed to the influence of heat. One of the difficulties which attends the construction of small boilers in which it is desired to generate strong steam at a very rapid rate, arises from the destruction of those parts of the boiler, within which water is not contained by the action of a furnace in that state of fierce combustion which is always necessary for the rapid production of steam in small boilers. To give the Committee some notion of the injury arising from the action of the fire on the metal out of contact with water, I may state, that I have witnessed myself a set of new grate bars melted in a single trip between Manchester and Liverpool, within the space of an hour and a half. In Mr. Gurney's boiler every part which is exposed to the action of the fire, whether directly or indirectly, is filled with water; even the grate bars themselves are tubes of iron filled with water. The consequence of this arrangement is, that as fast as the fire imparts heat to the metal, that heat is taken up by the water, and carried off to the superior parts of the boiler. I am not aware of any other locomotive boiler in which this end is so perfectly attained.

886. You have stated that that is the effect; but you have not stated the cause, or the difference of structure, that produces that effect?—One difference is, that in the other boilers the grate bars are solid iron, and the fire of course destroys them in the way I have stated. In this case the grate bars are filled with water. There is another point, the grate bars slope upwards, rising towards the back. When the fire imparts heat to the water it does either one of two things; it either renders the water hotter, or converts it into steam. In either case that renders it lighter; consequently it acquires a tendency to ascend, and it runs up to the back of the grate. There it encounters another set of tubes in the back of the grate, and it rushes upwards through them; it then encounters a third set of tubes which form the roof of the grate, and those tubes slope in the contrary direction to the lower ones, for they slope upwards from the back to the front; consequently it will again ascend, and it rushes back to the front of the grate; there it will rapidly pass into the state of steam, because it has already been heated in the bottom and in the back of the fire-place, and it is exposed the less to the radiant heat of the fire below. In the front of the grate there is a chamber to receive the steam thus formed, which subsequently works the engine. I do not know that any other form of engine possesses those qualities in the same degree.

887. How is the water kept in connexion with the lower portion of the tubes?—In the front of the grate there are three strong cylindrical vessels, iron vessels, placed across, one above another, communicating between the top and the bottom of the grate by two strong upright cylinders all filled with water; in the cylinder below the grate are inserted the tubes that form the grate itself, and in the cylinder above the grate are inserted the tubes that form the roof of the fire-place. Now the Committee will see that there is an open communication from the cylinder below the grate, through the tubes that form the grate bars, through the tubes that form the back of the fire-place, which are vertical in their position, and then again through the tubes that form the roof of the fire-place, communicating with the cylinder which is at the top of the door of the fire-place; so that there is a complete communication all the way round. Now the cylinder which crosses the top of the fire-place, and the cylinder which crosses the bottom are united by vertical cylinders, so that there is a circle of water running completely round; the steam bubbles rising continually into an upper chamber apart from the action of the fire.

888. Have you ever seen this in glass models, so as to speak from actual observation,

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observation, as well as theory?—Yes; I have seen a small model, in which the tubes, both in the bottom and in the back and in the roof of the fire-place, were of glass, so that one could see all that was going on; and one could see the water running with prodigious rapidity round, the steam bubbles forming and rushing out at the top.

889. Are you of opinion that circulation is essential to a boiler of that kind?—Quite essential; indeed all attempt it more or less. It is indispensable.

890. Do you consider Mr. Gurney to have been the first person who devised that plan?—I do, in its application in this way; tubular boilers are not new, but this form of tubular boiler and its application are entirely new.

891. The practical result of that is, that the water is kept in contact with the tubes by that process?—Yes.

892. Will you explain to the Committee what you mean by a separator?—

In ordinary boilers the same vessel is a receptacle for the water and the steam, the water occupying the lower and the steam the upper part of the boiler; the state of ebullition in which the water is usually maintained is such, that the water is dashed up among the steam in the upper part of the boiler, and much of it remains suspended in the steam in a minute state of mechanical subdivision. It is found necessary in large boilers to leave a considerable height between the surface of the water and the roof of the boiler, in order that this spray may subside without passing through the steam tubes into the cylinder; this spray is what engineers call *priming*; and as it has no elasticity, it is mere waste of heat, besides other injurious consequences, if it be allowed to pass through the cylinder. The separator is a contrivance invented by Mr. Gurney, and is a steam chamber distinct and separate from the boiler; its object is to effect the separation of the priming from the steam before the latter is allowed to pass into the working cylinder. I have seen perfectly dry steam rush from the steam-pipe of the engine, and this would not be the case if the separation were not complete.

893. Then you consider the separator that separates the water from the steam, to be a material part of any boiler that is to be applied for the purpose of running steam carriages on common roads?—Perhaps not of all boilers; the steam chamber may be so great that the water will separate itself, as it does in a large steam engine, but in a small boiler of this kind I think it a very material appendage.

894. And none but small boilers can be applied for the purpose of those steam carriages?—I think not; I have seen boilers of considerable size applied, but not with advantage.

895. Do you at all happen to know the opinion of the scientific world, at the two different periods of the commencement of the running of those carriages upon roads, and the present opinion?—The scientific world is generally applied to men of abstract science, in contradistinction to practical engineers and manufacturers; and I must say, that I think that men of abstract science too often entertain distrust of projects pretending to great advancement in practical improvement. A conspicuous example of this may be remembered, when it was proposed to extend steam navigation from rivers to the open sea; the project was generally scouted by scientific men, who could scarcely be prevailed upon to listen to it for a moment with patience. I think their opinion was extremely adverse to the probability of the success of steam carriages; the experiments both on rail-roads and turnpike roads have, however, produced some degree of conviction, and I believe there is a more favourable opinion now than heretofore.

896. Have you had any communication with practical engineers upon this subject?—Frequently.

897. Can you speak as to their opinion?—I think theirs is certainly more favourable, but the fact is, that such large interests are involved, that you can hardly ever get an opinion which is a genuine one. If you consult an engineer who is engaged in railways (and this comprises a large section of the profession), you will find invariably that he will express utter incredulity of the possibility of ever working the steam engine on common roads. If, on the other hand, you consult other engineers who have been much engaged in the construction of turnpike roads, you will find prejudices quite as violent, and a bias not less disproportioned to the evidence in favour of the project of working turnpike roads with steam against railways. In neither case, do I conceive such opinions

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of any value. I believe the steam engine applicable, practically, both to railways and turnpike roads, with advantage; less, perhaps, in each case than the advocates of the respective systems represent, but certainly with more advantage in both cases than horse power.

898. Your opinion is, that if that bias did not exist, their judgment would lead them to decide in favour of this improvement?—I think it would.

899. Can you at all account for this steam carriage, which has now been invented for some years, not having come into practical operation sooner?—I think it arises, in some degree, from the distrust of capitalists in its success, but much more from its being notorious that in cases where those carriages have been established, prohibitory tolls have been laid upon the roads, so as to render it impossible to run them; and although prohibitory tolls are not laid upon all roads, there does exist this idea, that the moment a steam carriage is built and placed on a road, the projectors are liable to be stopped immediately by a prohibitory Bill being passed.

900. Do you think that cause sufficient to create a distrust in the minds of the capitalists?—I do, certainly.

901. Do you think there is any one to divide the credit of this invention with Mr. Gurney?—I do not know that there is, so far as respects the original invention. I think that since Mr. Gurney first promulgated his ideas and reduced them to practice, there has been much done in matters of detail on railways, and also in carriages for common roads. For instance, the producing a blast through the fire, by projecting steam through the chimney, is one of the greatest improvements that has been brought forward. That was brought out, I believe, by accident at the time of the carriages being constructed for the Manchester railway. Mr. Gurney has adopted it with great advantage in his steam engine.

902. Then you conceive that was not an invention of Mr. Gurney's, putting the steam through the chimney?—I am not aware that it was.

903. Are you aware of the date of that improvement?—I do not know it. I am speaking now from hearsay. I understand it was discovered accidentally by a person who constructed one of the engines that ran in the year 1827, on the Manchester railway, Mr. Hackworth; I have always been informed, that in the construction of his engine he discovered the principle accidentally. He threw his steam into the chimney, not knowing what else to do with it, and found it to produce that effect.

904. What date was that?—It must have been before 1827; but I cannot say exactly when. Probably only the year before, because the competition was proposed by the Railway Company at that time. It was, most probably, late in 1826 or early in 1827. I think I cannot trace it back with railway people, or with competitors on the railway, before 1826. I should also state that the manner in which the steam is thrown into the chimney in rail-road engines is attended with a loud coughing noise, which would be quite inadmissible on turnpike roads. Mr. Gurney has contrived an improvement by which this objection to its adoption is removed. Instead of allowing the steam to escape into the chimney directly from the cylinder, he receives it into a separate vessel or blowing box, from which it is allowed to pass into the chimney in a continuous stream without noise.

905. Do you conceive that steam carriages could have been run on common roads without all the advantages you have described as emanating from Mr. Gurney's invention?—I decidedly think not, though those advantages may possibly be obtained by other means; but obtained they must be, otherwise they could not run with advantage.

906. You conceive that any carriages that have since been adopted, are, in fact, only modifications of Mr. Gurney's principle?—I think in spirit many of them are so. They are substantially modifications, though I do not mean to say that they are infractions of his patent.

907. Is it your opinion that Mr. Gurney's carriage can be run with safety to the public?—I think it can, when constructed with proper proportions and proper strength.

908. By following out his principles?—Yes, decidedly.

909. Has it ever occurred to you to make any estimate or to see any estimate of the comparative cost of running those steam carriages and running four-horse coaches?—Yes, there is a calculation contained in the Report by Mr.

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Gurney himself before the Committee of the House of Commons on steam carriages, in 1831, which I have seen, and it did appear to me to be a fair one.

910. Do you remember the results of that calculation?—Not exactly.

911. Are they much in favour of the cheapness of steam?—Yes, very much; immensely.

912. Do you conceive the machine so complete at present, that in building a carriage it would run for a length of time as would be advantageous?—I think the improvements which it requires to adapt it for permanent and advantageous work are chiefly those matters of detail relating to the proportions and comparative strength of the parts which persons skilled in coach-making and practical engineering would be more competent to suggest than the inventor himself, or any other scientific man.

913. Is it your opinion that great improvements might be made in steam carriages which have no relation to the principle of invention, but in matters of detail; certain workmanlike improvements?—Yes, I think that is the rock upon which all steam inventors have split. They have not had recourse sufficiently to working engineers and coachmakers, but have attempted to execute themselves, what required an apprenticeship to several trades to be able to perform efficiently.

914. Have you had any correspondence with members of foreign learned societies upon this subject?—No.

915. Are you not aware of any other carriages of this kind?—Not out of this country: it is said there was an American, a man of the name of Evans, who exhibited some such experiment at a very early period.

916. Has it ever occurred to you to see the steam carriage made by Mr. Hancock?—Yes.

917. Do you think that Mr. Hancock can claim any merit which is supposed to belong to Mr. Gurney in reference to steam carriages?—No.

918. Could you at all speak of the difference between Mr. Hancock's carriage and Mr. Gurney's?—In the way in which the water is exposed to the action of the fire, there is the same difference as there is between tape and rope. Mr. Gurney exposes the water in round threads or cords, Mr. Hancock in thin flat plates.

919. Is it your opinion that Mr. Hancock has endeavoured to disguise Mr. Gurney's child, so that he should not know it himself?—There are essential differences between them, and these are, I think, in favour of Mr. Gurney's. I might mention various points; in the first place, Hancock's grate bars would be burnt out in two or three trips, and I believe they have been so destroyed.

920. Do you think any merit that belongs to Mr. Hancock's is borrowed from Mr. Gurney's?—In Mr. Hancock's boiler I cannot see any of the advantages observable in Mr. Gurney's.

921. He does not adopt those principles recommended by Mr. Gurney which you consider to be so necessary to success?—He does not: I think there is scarcely any thing in common to them.

922. Will you explain the difference?—First, The form of Mr. Gurney's boiler being in every part cylindrical, is that which is most conducive to strength. The form of Mr. Hancock's boiler being that of thin flat plates, is that which is least conducive to strength.

Second, Every part of Mr. Gurney's boiler which is exposed to the action of the fire contains water in a state of circulation, and is therefore not injured by undue temperature. Considerable portions of Mr. Hancock's boiler not containing water, are exposed to the action of the fire, and are therefore liable to destruction by undue temperature.

Third, The probability of explosion in Mr. Gurney's boiler is lessened by both the above causes. The probability of explosion in Mr. Hancock's boiler is increased by both the above causes.

Fourth, No means are provided to separate the priming from the steam in Mr. Hancock's boiler. The separator is intended to produce that effect in Mr. Gurney's boiler.

Fifth, Mr. Gurney avails himself of the waste steam to blow his fire. Mr. Hancock blows his fire by a fanner worked by the engine, at the expense of a considerable portion of his power.

923. Do

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923. Do you think those differences between Mr. Hancock's carriage and Mr. Gurney's are probable causes of the failure in Mr. Hancock's carriage?—I think very probably.

924. Do you think that the difference between Mr. Gurney's carriage and Mr. Hancock's will be probable cause of success in Mr. Gurney?—I think they will be conducive to it.

925. Did you ever hear of any failure in those boilers, in consequence of this form of Mr. Hancock?—I heard of an explosion of Hancock's boiler, and a man being killed by it.

926. How long is that ago?—I think it is about a year ago.

927. Did you ever hear of any such accident occurring to Mr. Gurney's carriage?—Never.

928. Are you aware of any recent excursion that has taken place for any long distance with steam carriages?—Yes, there has recently been steam carriages running between Glasgow and Paisley.

929. Does there seem to be any popular objection to it there?—No; on the contrary, they are always fully loaded.

930. Upon what principle is that carriage built?—I am not aware.

931. Have you any reason to suppose that it is built upon a different principle from that of Mr. Gurney's?—I have no information about it; I have written to Edinburgh to ascertain, but I have not yet received an answer.

932. Are you aware of any journey that took place from London to Birmingham?—Yes; the carriage which undertook that journey was that of Sir Charles Dance; it had previously been running between London and Greenwich, and I have more than once travelled on the engine to observe its performance.

933. Are you aware of any excursion that took place from London to Birmingham in the last few months?—Only by hearsay.

934. Are you aware that a separator was taken away from that boiler?—I merely heard that it was so, but I am not aware of the fact.

935. Was there any accident occurred in that expedition to Birmingham?—I think that an accident occurred beyond St. Alban's.

936. Of what nature?—A tube burst.

937. Would the accidental or the intentional omission of the separator have led at all to the bursting of that tube?—If that omission had produced a waste of water, so as to cause the boiler to boil dry, it might.

938. How long after Mr. Gurney's success did Mr. Hancock's steam carriage come out?—I have only heard of Mr. Hancock's carriage within the last two or three years.

939. Do you think it would have come to your knowledge if it had existed in any practical shape before?—I think most probably it would, for I inquire very much after these things.

940. Your opinion is, that whatever credit may be due to Mr. Hancock, the priority is due to Mr. Gurney?—Clearly.

941. You do not apprehend that there is any thing in Mr. Hancock's invention that exceeds in value Mr. Gurney's invention?—None whatever, but very much the reverse.

942. Have you ever printed anything upon the subject of steam carriages?—Yes, I have published a work on the steam engine, and I have written occasional essays in the Edinburgh Review upon it.

943. And you have given particular attention to the subject of steam?—A good deal; a very large attention to practical science generally.

944. Are you a Fellow of the Royal Society?—Yes.

945. Are you of opinion that the invention is now completed sufficient for practical uses?—I think it is as much in a state of advancement as inventions of this kind generally are when they first come into practical use. It is as much, and perhaps more, advanced than the knowledge of steam navigation was when it was first practically applied. Of course, experience would from time to time, as is always the case, suggest improvements; but I think the invention is now as far advanced as mere experimental carriages and engines are likely to carry it. Further improvement can only be obtained by experience on a much more extensive scale; such experience as a regularly established line of carriages alone could supply.

946. You see no danger to the public from their working?—Not the least; I have not the least objection to travel on the engine myself.

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947. And you have stated that it can be done with greater cheapness than it can be done by horses?—I have no doubt of it at all.

John M'Neil, Esq. called in; and Examined.

948. WHAT is your profession?—Civil engineer.

949. Can you at all speak as to the originality of Mr. Gurney's invention of steam carriages?—I have always considered Mr. Gurney as the first person who really introduced steam carriages upon turnpike roads.

950. Is that the general opinion among engineers?—As far as my experience extends, I think it is, but I am not so well acquainted with mechanical engineers, and those connected with steam engines, as I am with that class of civil engineers who are principally employed on harbours, roads, bridges and such works.

951. Do you think it would come within the sphere of your knowledge, if any one had previously invented a carriage of this sort?—I think it would; I never heard it questioned; indeed I do not think there can be a doubt of it. Mr. Trevithick, it is true, was previous to Mr. Gurney, but his carriage was more applicable to rail-roads than to turnpike roads.

952. You never heard of Mr. Trevithick having invented a steam carriage to run upon common roads?—I have heard it stated that he tried his steam carriage on turnpike roads, but that it did not succeed, and that he at once sent it to a railway at Merthyr-Tydvil.

953. Your opinion is, that if he invented a steam carriage he failed in that, and applied his invention to rail-roads rather than to common roads?—I believe the facts are, that Mr. Trevithick did make a steam carriage for the express purpose of running upon turnpike roads, but failing in that object he applied it to rail-road purposes.

954. Were you examined on the Committee on steam carriages, in the year 1831?—Yes, I was.

955. Have you seen any reason to change the nature of the evidence which you then gave between that and this time?—No, I have not; but there were some questions I was asked on that occasion, relating to certain subjects, with which I was not then so well acquainted as I am at present, having since attended more to the subject of steam carriages on turnpike roads; I am therefore now better informed on those points.

956. Will you state those points if you remember them?—One was as to the injury done to the roads from the passing of steam carriages over them; I had not paid much attention to the subject, and besides there was but one or two steam carriages at that time running on turnpike roads; I had never been in one on such roads previous to that examination, but since then I have been in almost every carriage that has been made for that purpose.

957. Can you state any other point?—Upon that occasion, I stated that though I was not quite certain, yet from some examinations I had made as to the wear of iron in the shoes of horses, compared with the wear on the tire of the wheels of carriages, that the injury done to turnpike roads would be much less by steam carriages, in the event of their running over them, than that caused by mail and stage coaches drawn by horses. Since then I have had practical experience on this point, and have carefully examined the roads in different parts of the country where steam carriages have been running, and I have every reason to believe that the opinion I then gave was quite correct; indeed I have not the least doubt in my mind, that if steam carriages ran, generally, upon the turnpike roads of the kingdom, one half the annual expense of the repairs of these roads would be saved.

958. Do you mean that if there were a steam tug attached to a steam carriage, the eight wheels, under those circumstances, would be less injury to roads than the trampling of four horses?—I decidedly think there is much less injury done by the steam carriage.

959. Do you remember any other point?—Yes; there was some question as to the law of resistance of carriages travelling with different speeds, and the power that can be exerted by horses at different velocities. I have investigated these subjects since that time with a good deal of attention, but to explain it requires an algebraical formula. I have, therefore, brought a short abstract from the paper I have drawn up on the subject; if it is of any use, I shall be happy

happy to hand it in. I could at the time the Committee sat, in 1831, speak as to having seen only one steam carriage on a turnpike road, and as to the effect produced upon the horses which passed it on the road. From considerable experience since that period, I am quite certain that in a very short time there will be no complaint of horses being frightened by steam carriages; I do not know that I have seen more than two or three horses in all my experience that were at all frightened by any of the carriages I travelled with, and I have passed many times through some of the most crowded streets in London and in Birmingham in steam carriages; I have also seen horses out in the morning led by grooms, which would in all probability be startled by any object which was at all likely to frighten a horse, and they did not take the least notice of the engine. At another time, several ladies passed on horseback without the least alarm, and some of them rode close after the carriage and alongside of it, as long as they could keep up with it.

960. Whose carriage was that?—It was Mr. Gurney's steam carriage; it was then the property of Sir Charles Dance; I have also witnessed the same results in Mr. Hancock's carriage, and in Colonel Macerone's, in the neighbourhood of London.

961. You say that you have travelled on almost all the steam carriages which have commenced running; is it your opinion that they could be run with safety to the passengers?—Yes, I think with perfect safety; indeed with far more safety to passengers than the present fast coaches drawn by four horses.

962. Is it your opinion that they could be run with greater cheapness than a coach drawn with four horses?—That is my opinion; but I am not able to say from actual experience that such will be the fact.

963. Have you made any calculation?—I have.

964. The result of that calculation is, in your opinion, that they could be run with greater cheapness than four-horse coaches?—Decidedly; there has been a company established for the purpose of improving the present road and running steam carriages between London and Birmingham, of which company I am the engineer; on that occasion it was necessary to form an exact estimate of the expense, to ascertain what the probable profit might be to persons desirous of embarking in such an undertaking; and that calculation I now have with me.

965. Are you at present engaged in building a steam carriage?—Yes; along with a few other persons.

966. On the part of the company or of yourself?—Not on the part of the London and Birmingham Company; a number of engineers and other persons, (of which party I was one) who went in Sir Charles Dance's carriage (the one which he purchased from Mr. Gurney) as far as Stony Stratford, were so convinced of the practicability of running steam carriages on turnpike roads, that we entered into an agreement amongst ourselves to build one. Mr. Donkin (who was also of the party), Mr. Cubitt and myself were appointed to take the management of it.

967. Where is that being built?—By Messrs. Maudsley & Field.

968. On what principle is that carriage being built?—The boiler is, I understand, one for which Sir Charles Dance and Mr. Field have taken out a patent.

969. Is it Mr. Gurney's boiler that has been adopted?—There are alterations in it, otherwise they could not have taken out a patent.

970. Did you enter into any contract with Mr. Gurney for the use of his boiler for this carriage?—None.

971. Could you have used Mr. Gurney's boiler without doing so, if it were Mr. Gurney's boiler?—I cannot say that we could; I had understood that Sir Charles Dance was in possession of Mr. Gurney's carriage and patent; I think he told me so himself.

972. In what respect does the boiler which is being made by Messrs. Maudsley & Field differ from that of Mr. Gurney?—I believe the great difference is, that there is no separator; but whether that constitutes the ground of the patent which Mr. Field and Sir Charles Dance have taken out recently, I do not know.

973. Do you feel yourself competent to give an opinion on the subject of steam boilers?—I should not like to give an opinion as to what will ultimately be found to be the best boiler to be employed in steam carriages; but I am quite sure there is no danger to be apprehended in any of the boilers that I have seen in use.

974. Do you think that there will be any danger by the use of the boiler

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which you are at present in the act of having made for yourself?—My opinion is decidedly that there will be no danger. Mr. Field, who has been long practised in works of this description, stated it as his opinion that there would be no danger, and I look upon him as the best authority in the kingdom.

975. You do not consider the separator, or the two separate vessels which connect the tubes in Mr. Gurney's boiler, is substantially necessary?—I am not sufficiently acquainted with the subject to say whether it is absolutely necessary or not; but I think the fact of Mr. Field excluding it, a strong presumption that it is not.

976. What in your opinion have been the causes from which the science of travelling on roads in carriages propelled by steam has made so little progress from the time that they were first made to the present time?—I think one cause of it is, that the Bill which was brought into Parliament to give steam carriages the right for a certain fixed toll to pass all turnpike gates, did not pass into a law. I have had a great deal of conversation with Mr. Heaton of Birmingham on the subject, and I certainly understood from him that the uncertainty with respect to tolls was a very great drawback to persons interested in bringing forward steam carriages.

977. Who is Mr. Heaton?—He is a person who along with his brethren has taken out a patent for a steam carriage on a new principle, to run in the neighbourhood of Birmingham, and has commenced building carriages under his patent.

978. And he states that the high prohibitory tolls which have not been removed by a Bill which was brought into the House of Commons and did not pass the House of Lords, has been an obstacle in his way in running steam carriages upon common roads?—Yes, I understand him to say so.

979. That opinion of Mr. Heaton could be only in reference to such roads where tolls existed, which would be higher than the tolls which would have been placed supposing that Bill had passed the House of Lords?—There were several Bills at that time about Birmingham, which were proposed to be renewed, and in one or two instances there was a toll put on steam carriages. I do not recollect what it was, but Mr. Heaton complained exceedingly of it, and he looked principally to the roads in the neighbourhood of Birmingham for running his carriages, and he was afraid of the prospective tolls being injurious to him.

980. Then Mr. Heaton was more connected with the local inconvenience than with the general inconvenience?—I think that was the case; but I also believe that he thought there should be a general fixed toll upon all steam carriages; this would have an influence on persons who would be likely to undertake the running of steam carriages upon turnpike roads.

981. Have you of your own knowledge known of any instance where any person whose attention has been directed to the subject, has failed from prosecuting these inquiries by the amount of toll which has been placed on all the roads?—No, I have not.

982. Do you believe that if a person were to commence such a plan, he would think it desirable to lay out money in the execution of these plans, and would not be deterred by the tolls which existed on particular roads, and that he could not find roads not subjected to such tolls, on which he could carry into effect those plans?—I think in the present state of the science of steam as applicable to road carriages, that he would have the same difficulties; the feeling of the public in favour of steam carriages having altered so much within a very few years; every one almost is now favourable to them. I think that not one in a hundred is against them; and those opposed to them are, generally speaking, interested persons.

983. You do not think it has any effect?—At present I do not think it has.

984. How many persons, since the period that you were examined, have continued their experiments in steam carriages on the roads?—I think Mr. Hancock, Dr. Church, Sharpe & Roberts at Manchester; Colonel Macerone, Heaton's at Birmingham, Russell's in Glasgow, Ogle's, Sir Charles Dance, and Maudsley & Field in London.

985. Have Maudsley & Field attempted one independent of Sir Charles Dance?—Yes, I was out in one such not a week ago.

986. You have enumerated nine persons; how many of those were engaged in the subject at the time you were examined?—There were Messrs. Gurney, Hancock,

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Hancock, Church, Ogle, Sir Charles Dance, and I believe Colonel Macerone ; these were all I knew of at that time.

987. Were those parties that ran at that time running for profit, or by way of experiment?—Mr. Hancock, I think, was the only person that I am acquainted with that was running for hire at that time.

988. The rest were experiments?—Yes.

989. You have enumerated five that were running at that period ; do they still continue their experiments?—Yes, all upon that list.

990. Not only five have continued their experiments since your examination ; but five others have commenced experiments on the subject?—Yes.

991. And have gone to the expense of building carriages?—Yes, joined with some other persons.

992. Have you heard of any others?—I am not acquainted with any others.

993. You have spoken of a gentleman of the name of Heaton, of Birmingham, constructor of steam carriages, and that he gave up in consequence of some tolls being imposed that he thought would prohibit him from securing any advantage?—No, he did not give it up on account of tolls, but he spoke of them as a great hardship, and one likely to prevent persons entering into a speculation of his steam carriage, especially at that time, as there were many Turnpike Acts about to be renewed ; and it was then the general opinion amongst the trustees of roads, that steam carriages would injure the roads and the receipt of tolls ; and that consequently they would be very likely to put on the same high tolls on any Turnpike Acts that were to be renewed, as had been exacted in other parts of the country ; in one case of which he had seen a very bad result, the case of Sir Charles Dance, between Cheltenham and Gloucester.

994. In what year was that?—That was, I think, about two years ago.

995. Somewhere in 1832?—I think it was.

996. Had Mr. Heaton received any impression dangerous to his experiment from prohibitory tolls having passed the Legislature on other roads?—He was aware of such tolls having been exacted, and had such an impression.

997. And he conceived that these were detrimental to the success of steam carriages on those roads?—Decidedly.

998. Was he aware of a Committee which sat on steam carriages in the year 1831?—Yes, he was.

999. Was he aware of the recommendation of the Committee to the Legislature on the subject, so as to take off the prohibitory tolls?—I think he was, for he stated to me that he saw The House were not going to remove the obnoxious tolls then, some difficulty having attended the proposed alterations.

1000. How did he draw the conclusion that The House was then minded to continue those prohibitory tolls?—From the fact of the Bill that was proposed to alter and amend the former Road Acts not passing into a law.

1001. He was aware of a Bill having passed the House of Commons and failed in the House of Lords?—Yes, certainly ; but I do not know that he was aware in what stage of the Bill it was lost, but he was aware of the fact.

1002. Was it after the loss of that Bill in the House of Lords that he had intimation that some road trusts wanted renewing in the neighbourhood of Birmingham, where he was going to use his carriage?—I do not know exactly whether it was previous or subsequent to that event.

1003. Was it about that time?—It was ; I had been consulted by several trusts in the neighbourhood of Birmingham about that period as to the mode of charging tolls on steam carriages.

1004. Was it his opinion that if he continued his carriage, these trusts would have a clause in their Act putting tolls so high as to put it down?—He was afraid of it.

1005. Had that any effect upon the discontinuance of his steam carriage?—No, I think it had not ; because there was a company formed soon after, which took up his scheme ; their capital was to the extent of 10,000*l.* ; he entered into an agreement with those parties to build carriages for 500*l.* apiece, to run certain distances.

1006. Did he ever build carriages for that company?—He did.

1007. Were those carriages ever run?—One was run for a short distance.

1008. In what district?—In the neighbourhood of Birmingham.

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1009. How long did it run?—I believe it was never run but once or twice, so far as I have been able to learn, and that merely for experiment.

1010. What was the cause of its being given up?—I do not know.

1011. How long had those carriages run?—The first that he built on his own account had been running for several months; I travelled with it on some of the steep hills about Birmingham.

1012. Had it any connexion with Mr. Gurney's principle?—No; it had the same boiler as used in the locomotive carriages on the Manchester and Liverpool Railway.

1013. A tubular boiler?—Yes; the tubes surrounded by water, and the fire passing through them.

1014. Did he run that previous to 1831?—No, I think it was since 1831.

1015. Then the fact is, that Mr. Heaton's carriage had never run upon those roads in the neighbourhood of Birmingham more than once after those prohibitory tolls were imposed?—The carriage that he built upon his own account ran several times; the carriage that he built for the company ran but once or twice.

1016. That was for the sake of profit, and the carriage that he built for himself was for the sake of experiment?—Yes; I am not aware that he took any money from the passengers that he carried between Birmingham and Wolverhampton.

1017. The amount of those tolls would not prevent any experiment, but would prevent merely any person running for the sake of the profit?—Generally speaking, I think they would not prevent experiment; but Mr. Heaton stated he had difficulty in going out in the neighbourhood of Birmingham, arising from the tolls that were charged on his carriage.

1018. Were you at all connected with Sir Charles Dance in any of his experiments?—No further connected, than having gone out with him to see the performances of his carriage.

1019. Upon what occasions?—I have gone to Greenwich several times, also to Norwood, and up and down most of the high hills in that neighbourhood.

1020. Were you with him in his Gloucester and Cheltenham experiment?—No, I was not; but I went with him to Stony Stratford, in company, as I have stated, with several professional engineers and other persons. The result of that experiment, though not a successful one, was such as to alter the opinion of some of the engineers present as to what would be the result of steam carriages upon turnpike roads. I have in my hand a Report which was signed by the gentlemen who witnessed that experiment.

1021. The professional gentlemen who attended upon that expedition became generally favourable to travelling on common roads by steam carriages, although that experiment was not so successful as some preceding ones?—It was not so successful as any of the others; the roads were in an exceedingly bad state, and I believe the boiler was not in such good repair as on other occasions. Several engineers had never seen a steam carriage travel on a turnpike road until that trip: in fact, a short time before, it was looked upon by many persons as quite visionary. On seeing this experiment, several became satisfied of the benefit it would be to the country.

1022. You, who had made prior journies with Sir Charles, did not conceive that the one to which you allude, which had this effect upon the opinion of these engineers, was the most successful you had witnessed?—It certainly was not one of his most successful, but still it showed what might be done with a good engine.

1023. Was there any alteration in Sir Charles Dance's boiler for the purpose of that journey?—No; it was the same boiler that was used in the experiments to Greenwich, Norwood and Brixton.

1024. Was that Mr. Gurney's original boiler?—No; I think it was changed.

1025. Was there any separator?—No.

1026. Was it two inches wide?—The tubes were about one inch wide.

1027. Was the boiler without the separator like Mr. Gurney's, with that difference only?—It was, I think, different in other respects.

1028. Therefore, it is only a part of Mr. Gurney's principle that has been adhered to?—That is all.

1029. Then this journey cannot be considered as Sir Charles Dance's in connexion with Mr. Gurney, but the experiment of Sir Charles Dance's with Mr. Field, who had altered and changed Mr. Gurney's original experiment?—

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It was Sir Charles Dance's boiler, made in the country, and I think the experiment should be considered as Sir Charles Dance's alone.

1030. Can you state what was the cause of the failure upon that occasion?—The state of the roads was so exceedingly bad, that I think it arose in a great measure from that; in fact, I can show, by experiments made with an instrument that I have constructed to ascertain the draught of carriages upon roads, that, on that day, the power required to propel a carriage upon some parts of that road was at least three times as much as it would have been had the road been in a fair average state.

1031. Did not one of the tubes burst?—Yes; near Highgate there was one leaked, but the carriage went as well after that defective tube was taken out as before.

1032. Was the attempt to go to Birmingham, and the effect of that journey, equal to the journey of Mr. Gurney in the year 1829, four years before, made to Bath?—I was not present at the journey to Bath.

1033. Are you aware of any particulars of that journey?—I am not aware of any; but the general impression was, that that journey was more successful than the one to Stony Stratford.

1034. Has any journey equal to that been taken since, or has any improved apparatus taken place?—I think there was one journey to Brighton; but with that I am not acquainted. I believe it was a very successful trip; I was not, however, present at it.

1035. Was that Mr. Gurney's boiler?—I am not certain whether the alterations in the boiler were made at that time or not.

1036. Is Sir Charles Dance an engineer?—No.

1037. Does he understand any thing of the principles of engineering?—I should say that Sir Charles Dance is an amateur of practical science, not a professional engineer; he has distinguished himself as a military officer; I do not think he is so well acquainted with the subject of steam locomotion as Mr. Gurney. I have heard himself say, the whole merit of his carriage was due to Mr. Gurney.

1038. Has he any practical knowledge of mechanics?—I have had no opportunity of knowing the fact.

1039. Were you at all acquainted with the causes of Sir Charles Dance's stopping running on the Gloucester and Cheltenham road?—Merely from public report, and the statements made by Sir Charles to myself, which I quite believed.

1040. What were those?—That the trustees and other interested parties, and the surveyors of roads, put a large quantity of loose broken stones, to the extent of 16 or 18 inches in depth, upon particular parts of the road, which had the effect of stopping other carriages, both mail-coaches and stage-coaches, as well as Sir Charles Dance's steam carriage; I believe Sir Charles Dance would have got over that difficulty, because the public were opposed to it, and probably have had the stones removed; but about that period, (I believe the next week) there was a Bill passed establishing peculiar tolls, the effect of which was, upon steam carriages, quite sufficient to stop any steam carriage running on that road.

1041. Do you think that Sir Charles Dance would have persisted in travelling from Cheltenham to Gloucester in his steam carriage, provided those tolls had not been imposed?—I think he would.

1042. Have you heard him say as much?—Yes, I have.

1043. Was that travelling between Gloucester and Cheltenham made upon Mr. Gurney's principle?—I believe so, but that I do not know, not having seen the boilers at that particular time.

1044. Subsequent to that time, has Sir Charles Dance made any further experiments?—Yes, he has made several in the neighbourhood of London.

1045. Have those experiments succeeded?—Some of them have; for instance, the trip to Brighton was a very successful one, and also those that I have mentioned to Greenwich and to Norwood.

1046. Did he make any deviation from Mr. Gurney's original principle?—With the precise time at which he altered the principles of his boilers from Mr. Gurney's, I am not acquainted, but I rather think it was previous to going to Brighton, and I believe that and the trips to Greenwich and Norwood

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are the only ones that have been made with that carriage since the alteration took place.

1047. Was there a separator in the carriage when he went to Brighton?—I believe not, but I do not know; I do not know whether the alteration was made previous, but I rather think it was made before it went to Brighton.

1048. You have before stated that there was no separator in the carriage when it went to Stony Stratford?—There was none.

1049. You have spoken of a considerable number of persons who tried experiments upon the subject of steam carriages; were those original inventions of parties, or were they modifications or a copy of Mr. Gurney's invention?—Some are very close copies of the principle of that invention. I think that Mr. Hancock's is very little removed from it, but that it is not so safe as Mr. Gurney's, because flat chambers cannot be so strong as tubular ones; and I think that to a certain extent Mr. Ogle's is similar to Mr. Gurney's, because it was the separation of the water into small portions, that in this apparatus was very like the great improvement Mr. Gurney made. Dr. Church's boiler, I think, differs little from Mr. Ogle's; I am not acquainted with Mr. Gibbs's at all, nor do I know what he has done; of Sharpe's and Roberts's invention I have no knowledge; Colonel Macerone's is also, I think, nearly the same as Mr. Ogle's.

1050. Has he a separator or not?—I think he has a receiver, but I am not quite certain as to a separator; Sir Charles Dance's is in some respects the same as Gurney's. Mr. Maudsley's is more upon the arrangement of Trevithick; it has concentric cylinders.

1051. You think that all of those are more or less, except the last, either copies or modifications of Mr. Gurney's?—They are all tubular boilers, and divide the water into small portions, and so far resemble Mr. Gurney's.

1052. Do you think that where they have deviated from Mr. Gurney's they are improvements?—No, I do not think they are.

1053. You have stated those parties run for profit?—Mr. Hancock is the only one running for profit; he is about to run four coaches upon the Paddington road, as I am informed.

1054. Are there any tolls upon that road?—No, I think not for steam carriages.

1055. Is there an impression upon the public mind at this moment, that although prohibitory tolls have been imposed by certain trusts, there is a change in the temper of the Legislature upon the subject, and that it will not impose any more prohibitory tolls?—That is the general opinion throughout the country, and I think the feeling of the public has completely altered and changed within the last two years. I have had occasion, when upon the business of the Holyhead road, and the Birmingham and London Steam Carriage Company, frequently to see the trustees all along that line of road, and at several meetings of these trusts, relative to steam carriages, there were a greater number of trustees present than had ever before attended on any occasion; I think, in one instance, we had as many as 33 or 34 trustees. On every one of those occasions the trustees gave their full approbation to the principles of a Bill which we were desirous to introduce, last Session, for running steam carriages upon the roads of which they had the management; and within these three months I have been applied to by parties to examine the line of road from London to Bath, for the purpose of establishing another company, similar to that intended from London to Birmingham, by very influential people upon that line of road.

1056. Do you think that Mr. Hancock's carriage would travel, provided a toll were to be imposed upon the Paddington road?—It would depend upon what was the amount of that toll; if it was to be twopence a trip, I should say it would have little effect; but if it was to be four or five shillings a trip, which would not be more in proportion than has been laid on locomotive carriages on other roads, I think it would have a material effect, if not altogether put a stop to it.

1057. Do you conceive that although the prohibitory tolls might have created a panic upon the parties who were contracting for steam carriages in 1831, there exists now in the public mind, a feeling that the Legislature will not impose any more prohibitory tolls?—That is the feeling at present; I can speak with confidence to it.

1058. Do

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1058. Do you think that arises from the public being more convinced of the success of those steam carriages?—I do, and also from the spreading opinion that they will be a benefit to the country generally, I think the large proprietors of land, who formerly conceived that the introduction of steam carriages in doing away with horse labour, would be injurious to the landed interest, have quite changed their opinion, and that they now believe the country would be benefited by the introduction of steam carriages.

1059. Is it your opinion that the prejudices of the agriculturists and the public in general, are upon the wane, and that Mr. Gurney's invention is gradually gaining ground, even on the chance of those prohibitory duties?—Yes, that is my opinion.

1060. That it is gaining confidence?—Yes, every day.

1061. Had the question of tolls any effect upon the formation of the company of which you are engineer?—No; for we had proposed to introduce a Bill, charging a certain toll upon steam carriages passing over the road; but that toll would not be more than would be required for the purpose of paying for the repairs of the road, and the interest of a certain sum laid out upon the improvement of it.

1062. So that the Company thought the tolls a point of so much consideration, that they thought it necessary to introduce a clause into the Bill which they meant to bring into Parliament?—Yes, the persons who framed the Bill thought so; and the toll was proposed to be about the same as that charged on mail or other four-horse coaches, the steam carriage being to be limited to 25 passengers.

1063. Has any body contracted with Mr. Hancock to run his carriage on any line of road?—I believe there is a person connected with some merchants in Germany, who has purchased, or rather has got Mr. Hancock to build a carriage for them; it is, I understand, finished, and going out shortly.

1064. Are there English contractors to run upon any English line of road?—I have heard that several of those persons who are now engaged in running omnibuses, have agreed with Mr. Hancock to take carriages from him for the Paddington road; and on Tuesday last, when I was out with Mr. Maudsley, in his steam carriage, there were two persons who, I understand, were concerned in running coaches and omnibuses in the neighbourhood of London; one of them, I think, was a Mr. ———, who, I understand, keeps from 300 to 400 horses on turnpike roads; and he was so struck with the facility with which the steam carriage passed all other carriages, and cleared all corners of streets, &c. that he expressed his thorough conviction of the practicability of the scheme; and I have also heard, that as soon as steam carriages could be had, he has stated he would become one of the proprietors of them.

1065. That carriage is similar in every respect, except the boiler, to Mr. Gurney's?—It is more like the Manchester and Liverpool Railway engines.

1066. Are any of those parties running carriages now?—I have heard that Mr. Ogle was running, but not for hire; and Colonel Macerone is running at present very successfully.

1067. By way of experiment?—Yes.

1068. Do you think they look at all to the Legislature taking off those prohibitory tolls?—I think they do; the impression amongst them all is, that there will be a general Act passed placing a certain toll upon all steam carriages at a very small rate.

1069. And this is an inducement to them to make the experiments, preparatory to any Act of that kind coming into operation?—It is not the actual inducement to their making those experiments, but this expectation no doubt stimulates them.

1070. Do you think any of them are looking to the end of Mr. Gurney's patent?—I have no doubt, if Mr. Gurney's patent was thrown open to-morrow, there would be many new steam carriages commenced that are not now thought of.

1071. Do you conceive that it would be a great advantage to the public if Mr. Gurney's patent was thrown open?—I think so.

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1072. Do you think, considering the failure that has taken place, if persons were able to follow out Mr. Gurney's invention, without fear of trespassing upon his patent, that steam carriages would be more safe to the public?—I believe they are all safe enough; but I am of opinion steam carriages would be brought much sooner into general use if the patent was thrown open, that every person could avail himself of the advantage which has been gained by Mr. Gurney's experience; for I am persuaded that several have put themselves to great trouble to avoid infringing his patent.

1073. Do you think travelling can be carried on at half the price by steam carriages?—Yes, at less than half the present prices, and probably obviate the necessity of railways in certain districts where quick travelling is of consequence.

1074. Do you think at such a rate as the mail and some of the fast coaches go, steam carriages would be safer than other coaches at any rate?—I think a steam coach at the rate of 15 miles an hour, would be safer than the horse coaches at 10 or 11 miles an hour.

1075. Why do you think so?—When horses are brought to the speed of 11 miles an hour, which they are in many of the coaches now between London and Birmingham, they become very unmanageable. On going down hills the leading horses are perfectly useless, and frequently get in the way of the wheel horses; they give the coachman much trouble, and sometimes are the cause of serious accidents by the traces getting loose; there have been, within the last six months, three or four accidents between London and Birmingham, which I do believe, if steam carriages were introduced, would not have taken place, even if the speed was increased one half more than it is at present, that is, to 16 or 17 miles an hour.

1076. You think the safety of steam carriages is quite perfect?—If not quite perfect, decidedly more so than horse carriages.

1077. At the end of the last Report on steam carriages there were two or three tables affixed to it, and some answers given, in which a machine of yours is spoken of as determining the power necessary to propel carriages on different states of road and on various inclinations; have you made any experiments with that instrument further since that time?—Yes, I have made a good many additional experiments with it. I have put some of those experiments on paper; and if the Committee will allow me, I will read the statement.

[The same was handed in, and read, as follows:]

By a considerable number of experiments on roads of different kinds, the draught of carriages was found to agree very nearly with the results calculated from the empirical formula,

$$P = \frac{W' + w}{93} + \frac{w}{40} + C.V.$$

In which W' = the weight of the waggon;

w = the load;

C = a constant number, which will depend on the surface over which the waggon is drawn; and

V = the velocity in feet per second.

By putting $V = 3.7$, which was the velocity used in the experiments, the constant number C was found to be equal to 2 for a timber surface.

For other surfaces, the value of C may be taken as follows:—

On a paved road = 2.

On a well made broken stone road in a dry state = 5.

On the same road covered with dust = 8.

On the same road, wet and covered with mud = 10.

On a gravel or flint road, when wet = 13.

On the same, very wet and covered with mud = 32.

On an inclined plane the above formula becomes $P = \frac{W' + w}{93} + \frac{w}{40} + C.V. \pm \frac{h}{l} \cdot \frac{W' + w}{I}$

for a common stage waggon; and $P = \frac{W' + w}{100} + \frac{w}{40} + C.V. \pm \frac{h}{l} \cdot \frac{W' + w}{I}$ for a stage coach.

Experiments made in presence of his Grace the Duke of Richmond and Sir Henry Parnell, with the Road Indicator, or instrument for ascertaining the force necessary to draw

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draw a carriage over different kinds of roads and pavements, and consequently the actual condition of the road, 18 May 1833:—

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1st Trial 34 lbs.	2d Trial 30 lbs.
— 38	— 34
— 35	— 37
— 31	— 38
— 36	— 39
— 37	— 40
— 36	— 41
— 38	— 36
— 37	— 31
— 39	— 39
— 40	— 32
— 39	— 31
— 31	— 27
— 29	— 30
— 29	— 30
— 26	— 28
— 22	— 24
— 23	— 20
— 14	— 15
— 18	— 20
— 18	— 20
— 20	— 22
22)670(30'454 lbs.	22)664(30'181 lbs
66	66
100	40
88	22
120	180
110	176
100	40

The place of trial was in the Regent's Park, and the space passed over during each experiment was 220 yards of gravel road; the average draught in the first experiment was 30'454 lbs.; that in the second trial was 30'181 lbs., making a difference of '273 lbs., or little more than $\frac{1}{4}$ lb. in the distance of one furlong, which shows the accuracy with which the instrument works, and consequently with what precision the state or condition of any road may be determined by it, as well as the law of resistance affecting the draught of carriages at different velocities.

1078. Did those experiments lead you to determine at all the amount of horse power at different rates?—Yes, it has.

1079. Have you brought a formula?—Yes.

1080. That formula is in algebraical quantities; have you reduced that into common numerical tables, showing the comparative value of horse power and steam?—I have not compared it with steam, for this obvious reason, that there has not been a sufficient number of experiments yet made with steam carriages upon turnpike roads as would justify a comparison or a formula being made for them. Upon railroads we have it exactly, but I do not think those calculations would be correct if applied to steam carriages on turnpike roads. I propose, as soon as the steam carriage is completed by Messrs. Maudsley & Field, to investigate the subject, and to make a series of experiments, so as to ascertain the facts, and enable me to make accurate tables of the comparative expense of working carriages on railways and on turnpike roads, by steam and horse power.

1081. According to your experience and calculation you find that it is much in favour of steam power at high velocity all above seven miles an hour?—I should say all above four miles.

1082. And increasing in a very rapid ratio?—Yes, when you exceed ten miles an hour. I am of opinion that steam carriages may be run with very great advantage and success at the rate of 16 or 17 miles an hour on good turnpike roads.

1083. Without tramroads?—In summer, upon the roads as they now exist; in the winter it will be necessary to harden the roads by some means or other; but I do not pledge myself as to the mode of doing it. Granite tracks are one way, but there is another method, which I should wish not to mention at present.

1084. Supposing you double the speed from six miles to twelve, you use more
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coke in going over the same quantity of miles, and increase the expenditure of the fuel?—It is increased, but not increased very much.

1085. Did you ever hear of Mr. Gurney's carriage going up Highgate Hill?—Yes.

1086. Did you ever measure the inclination of that hill?—Yes, that hill rises one in eight for a short distance.

1087. One in eight is an unusually steep hill in public roads?—Yes, it is quite inadmissible.

1088. Then, in fact, of all those different inventors whom you have mentioned, Mr. Hancock is the only one who is about practically to use those carriages?—He is the only one practically using them for profit in this country; but there is a Mr. Russell, of Glasgow, who has carriages running at this moment for hire between Glasgow and Paisley.

1089. Do you know upon what principle they are running?—I am not aware of their construction.

1090. Are you aware whether there are any prohibitory tolls upon those roads?—I do not think there is any prohibitory toll.

1091. Are there any local Acts renewed for Scotland, imposing those prohibitory tolls at the time they were passed in Parliament?—I believe not.

1092. Do you think that if Mr. Gurney had gone on with his carriage in 1831, and the prohibitory tolls had not obstructed him, that Mr. Hancock's carriage would ever have come into existence?—Mr. Hancock's was in existence in 1831.

1093. Do you think if it had been running, the public would have preferred it to Mr. Gurney's?—No; I am sure they would not have preferred it, for the reason that the public would not at first like to be upon a carriage that carries the engine and boilers, if there was one like Mr. Gurney's drawing the passengers in a separate carriage after the engine.

1094. Is there a comparative difference between the degree of danger in the two?—I myself consider Mr. Gurney's boiler to be safer than Mr. Hancock's. I do not think there is much danger from either; but there has been a man killed by Mr. Hancock's boiler; but that accident arose from the improper conduct of the man himself fastening down the safety valve.

1095. Is it your opinion that the various contractors with Mr. Gurney in 1830 or 1831, would have given up their contracts if those prohibitory tolls had not been imposed?—That can only be a matter of opinion; but as far as that opinion goes, I think it is very possible that it may have had a very material effect in their giving up the scheme.

1096. Taking the subsequent success of steam carriages into calculation, and that Mr. Gurney is the inventor, do you think it probable that it was for want of success that they gave up?—I do not think it could have been the want of success on the part of the inventor, for it was doing every thing that could possibly be expected between Gloucester and Cheltenham.

1097. If Mr. Gurney's carriage was not given up in 1831, for want of success, can you assign any other cause than that of the prohibitory tolls that were imposed?—No; that is the only means that the public have of judging; I know of no other.

1098. Mr. Hancock was not running before 1831?—Yes, he was running before 1831.

1099. Is it your opinion, from your general experience of the roads in the different parts of the country, that those prohibitory tolls were a great injury to Mr. Gurney?—Yes, I think they were.

1100. Was there a general panic upon the subject, that the Legislature were in a temper to impose tolls in different parts of the kingdom prohibitory of steam carriages?—Yes, just at the time that the Cheltenham business was going on, the feeling of the public was very much alive to the subject; they conceived that it would injure the agricultural interests, the roads and proprietors of coaches and horses. I think the feeling generally was opposed to steam carriages; and that Road Acts, as far as it was necessary to renew them, would have clauses similar to those that had been passed on the Gloucester and Cheltenham road, imposing very high tolls upon steam carriages; I am persuaded it had a very great effect indeed in preventing persons from speculating in steam carriages.

1101. You think that that cause was sufficient to induce contractors with Mr.

Mr. Gurney not to fulfil their contracts?—At that period I think it was quite sufficient.

1102. Do you think that is sufficient reason for Mr. Gurney not having prosecuted his experiments further?—I think it was a very sufficient reason; the public opinion was against steam carriages.

1103. Do you think if those prohibitory tolls had been removed, there is any thing to prevent Mr. Gurney's carriages from coming into complete operation?—I think if Mr. Gurney had not been deterred by tolls and other causes, steam carriages would have been in full operation on the main roads in England.

1104. Was not Sir Charles Dance's experiment successful?—I conceive so.

1105. If that was successful, would not the running upon roads in general at that time have been successful?—Yes, I think so, but for the obstacles I have mentioned.

1106. Would there have been time for Mr. Gurney and his partners to have received a large fortune between the time that it was stopped and the present time?—I have no doubt that they would have received a very considerable sum of money, with great benefit to the public; I think it probable that many of the parties who are now prosecuting similar schemes would not have thought of them if Mr. Gurney had continued.

1107. But in consequence of his leaving off, they have endeavoured to evade his patent?—They are working upon schemes of their own.

1108. In consequence of the change of the opinion of the public?—Yes.

1109. If Mr. Hancock, or any body else, had been in Mr. Gurney's situation with respect to those prohibitory tolls, and contracts had been made with him for his steam carriage, do you think he would have persevered under those circumstances as he is now going on?—Certainly not; but I think if he had had a very large capital, he might not have been deterred; but there was quite enough to deter persons looking for remuneration.

1110. If he himself had been inclined to proceed in the experiment, or in running carriages, do you think that he would have induced the public to join him in it?—No, I do not think he could.

1111. Do you think the panic was so great that the public were unwilling to become contractors upon the subject?—Certainly.

1112. Do you think Mr. Gurney being in advance of all other manufacturers at the time, would have continued in advance as the subject went on?—It is reasonable to think he would.

1113. And that that would have given him a superiority in the market?—Yes; and I also think that the public would give Mr. Gurney a preference even now, if he was willing to take up the subject again.

1114. That is, with reference to the tolls not being imposed?—I look upon that as having gone by.

1115. It is only within the last six months that the great re-action has taken place in the public mind?—About six or eight months; and I think they have been greatly influenced by practical men, civil engineers having changed their opinion to a certain extent.

1116. Which has become decidedly favourable to the idea that steam carriages on common roads will succeed?—It has with many.

Mr. David Dady, called in; and further Examined.

1117. DID you accompany Mr. Gurney's steam carriage from London to Bath in 1829?—Yes.

Mr. David Dady

1118. Did you keep a journal of the particulars of that journey?—I have the particulars in writing.

1119. Will you have the goodness to give it in as evidence?—Yes.

1120. Have you it with you?—I have.

[It was handed in by the Witness, and read, as follows:]

MINUTES of a JOURNEY from London to Bath with Mr. Gurney's STEAM CARRIAGE, July 28th, 1829; which I have kept at the request of the Quartermaster General.

THE steam carriage was small; its weight about 30 cwt.; it carried its own fuel and water, necessary for a stage of six or eight miles; on the carriage was Mr. Gurney, with Mr. Stone and Mr. Bailey, the engineer; attached to it behind was Mr. Gurney's private carriage, containing his brother, Colonel Viney, Captain Dobbyn, and two engineers on the dickey.

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Mr. Hanning, of Dillington-park, Somerset; Sir Charles Dance, Mr. Bulnois, of Gower-street, and Mr. Davis followed it in a phaeton, drawn by a pair of post horses. Some difficulty was experienced in making the relays on the road of coke and water; and fearing that at some of them the coke would not be forthcoming, a post carriage, containing a charge of coke, was thought advisable to be taken in case of need; in this carriage was Mr. Dady, Mr. Gurney's confidential manager, and another engineer; this was the order of the procession, the steamer leading the way.

We started from Cranford Bridge Inn before five o'clock in the morning; the carriage, to avoid the crowd of London, Kensington, Brentford, &c. having been taken there through the night.

We started, and went at a great rate of speed. This road is level; at Salt Hill we met with the first rise, which was new laid with flints; the steam was well up, and the carriage did not seem to feel the inclination very sensibly; it proceeded on at a uniform pace to within a mile of Maidenhead, where the first relay of coke and water had been made. The phaeton and post carriage could not keep up with the steamer without great difficulty; while taking in water and coke at this station, the phaeton and post carriage passed us, and went on to Maidenhead to change horses. The carriage again started from this place, after taking in its charge of fuel and water, at the same rate as it travelled before: the horses which had posted from Cranford Bridge were in a lather, and so much distressed that we were obliged to put four horses to the post carriage, which we continued to do all the rest of the way. We travelled the first 14 miles within the hour: four horses were therefore deemed absolutely necessary to keep up. Nothing particular worth notice took place until we came to the inn, about a mile beyond Reading, where we stopped nearly three hours, waiting for an iron, which had been kept at Reading to be mended, and which had been broken under the following circumstances: On the River Colne, over which we had passed, a new bridge was building, and a temporary wooden one was raised for carriages to pass. This bridge was unusually high, and on arriving nearly to the foot of it, Mr. Gurney, who guided the carriage, perceived the leaders of the Bath and Bristol mail coming up on the opposite side. Both the carriages were proceeding at full speed, and a collision seemed inevitable; and that too on the centre of the bridge; they were so near each other that it was too late to stop the momentum of the mail or the steamer. In this perilous situation, Mr. Gurney, with great presence of mind, ran the steam carriage directly off the road against a pile of bricks, standing for the purpose of rebuilding the new bridge; thinking it better, under the circumstances, to break the carriage, than run the risk of injuries to the passengers of the mail or ourselves. The steam being cut off from the engine, the carriage, as it fortunately happened, was brought up against the bricks without any injury, except that of breaking the main iron, which connected one of the hind wheels to the engine which was attached. The mail having now sufficient room to pass, did so without any mischief whatever. It pulled up, and the coachman, with the guard and some of the passengers, came back to our assistance. The steam was now reversed on the engine, and the carriage propelled itself back again into the road. The engine acted on both hind wheels, or one at a time, as was found necessary; only one was connected at this time by the iron in question which was broken; the opposite wheel was then connected to its driving iron. We again proceeded on as before, keeping up the same rate; and on arriving at Reading we left this iron, which had been broken, to be mended. We waited nearly three hours for it at the inn, as above stated. We were impatient to get on, and at last did so without it, leaving orders for the post carriage to bring it on to the next station. We had great anxiety for the iron, which occasioned our waiting so long, fearing it might be wanted to connect to the wheels in some of the loose gravelly roads about Marlborough Forest, if not before. It was thought some part of the road would require the bite of both wheels. The carriage now proceeded without any thing particular occurring, until we came to the hill beyond Newbury, part of which was newly laid with flints; at the steepest part of it the working wheel of the carriage attached to the engine, slipped round on the ground, and the carriage stopped. The iron for connecting the other wheel was not come up; to wait for it was deemed impolitic; it was therefore thought advisable to get a horse to assist it out of the difficulty: one of the party was about to go on search of one, when two of the engineers put their shoulders to the carriage, and with this assistance it instantly propelled itself out of the difficulty, and proceeded to the top without again stopping. We all were much pleased to find how nearly the fulcrum or bite of one wheel alone was sufficient to overcome such a situation; and we afterwards felt less anxiety for the iron in the rear.

The road through Marlborough Forest is generally of a loose gravelly bottom, and very uneven. The carriage, however, went over it with considerable ease, and the bite of one wheel was found sufficient to propel it up all the inclinations. Since the descent of Highgate Hill, the carriage had never been tried down any one of great declivity; and we were very anxious in the anticipation of going down the one at Marlborough Hill. A drag chain in the ordinary way was provided, and also another of simple construction, which was made to act at the will of the director, by a hand drag, to regulate the velocity of the carriage down hills. In going down the hill, however, we found neither drag necessary, for the friction of the engine alone (the steam being cut off) was sufficient to arrest its descent.

From Marlborough we went on without any accident or interruption to Melksham, which is within eight miles of Bath. Here there happened to be a fair, and an immense crowd of people had collected together. The mass was so dense that it was impossible to move the carriage through them but at a very slow pace. The people were principally composed of agricultural labourers and the manufacturers of the district. They considered the carriage

injurious

injurious to their interests; they said it was a carriage driven by *machinery*." A cry of "Down with machinery," was raised in different places; and an attack of a very serious nature commenced upon the carriage and our whole party; some were seriously injured; Mr. Bailey, Mr. Gurney, and Thomas Martin, the assistant engineer. Some of the small connecting rods were injured; the more important working parts of the carriage were either too hot to be handled, or too strong to be damaged by the means then in the power of the mob. Here was an end of our proceeding further this day. Mr. Gurney was much disabled, and Mr. Bailey, our principal engineer, had been taken on to Bath in a post carriage, in an insensible state, from the injury he had received.

The carriage, on the journey, was observed to go slower after we had proceeded some distance; on inspection, the next day, we found a large quantity of earthy slag, commonly called clinkers, formed in the fire-place, which no doubt occasioned it. They had gone on gradually forming as we went along, and the fire, in consequence, was kept down. We took good care, on our return, to pull them out as soon as formed.

On our return from Bath, no persuasion or offers could induce the engineers to return through Melksham by steam. The carriage was therefore taken quietly through the town by night, to about a mile on the Devizes road. Here we lighted our fire, and as soon as the steam was up, commenced our journey back. Going into Devizes, there is a very steep hill, at the foot of which, we connected both wheels (the broken iron had now been mended) and the carriage propelled itself with the other carriage in tow up this hill at about the rate of seven miles per hour. At Devizes, a fresh supply of fuel and water was taken in at the Bell. The inhabitants, as if to show their feeling of the Melksham fight, treated the party with the greatest kindness. On leaving Devizes, a number of gentlemen accompanied us on horseback across the Down to Marlborough. The road there was firm, and in every respect good; the carriage proceeded with great rapidity, and kept the party on a gallop the whole way: within about three miles of Marlborough they left us. On topping one of the hills, about two miles before we reached Marlborough, a large crowd was observed on the great hill beyond it. A gentleman had gone on here the night before to make a relay of coke, who gave intelligence of our intended return. The engineers felt great apprehension of an attack, and in order to get up the hill as fast as possible, a strong fire was got up previous to reaching the town. Before we arrived at the foot of this formidable hill, the steam was blowing at the safety valve. We moved the carriage on steadily, until it came within a short distance of the steepest part, where the people were collected; the full steam was now laid on the engines; the carriage instantly yielded to the power, and went up with rapidity at a rate of not less than eight miles per hour. The dreaded crowd were found to be the most respectable people of Marlborough, who assembled from curiosity to witness the carriage go up this hill. Stage-coaches are frequently obliged to have six horses to go up this hill.

This success gave us great glee; and from this time, either by better knowledge of keeping up the fire, or by better coke, we travelled faster all the way to Cranford Bridge, our last station, where we arrived a quarter before five in the afternoon, having made the distance from Melksham, 84 miles, in nine hours and a half, including stoppages for taking in water. These stoppages, from the unprepared manner in which we took it in, were often and long; we were obliged to bucket it in; it occupied much time on the road, not less than a quarter of the whole. Our rate of travelling must, therefore, have been upwards of 12 miles per hour on the average. Some of the roads were firm and good; over these we did 14 miles per hour; other parts, where the gravel was loose and hilly, we did not average seven. The quantity of coke burnt was 56 bushels in going down, and 48 in returning; the difference we attribute to the clinkers before mentioned, and to the practical knowledge gained on our journey down, enabled the engineer to work the carriage better on his return. There was no accident of any kind; horses did not shy or start in meeting or passing us.

David Dady.

Alexander Gordon, Esq. called in; and further Examined.

A. Gordon, Esq.

1121. HAVE you any thing to add to your evidence of yesterday?—When I was yesterday asked as to the effect of the tolls upon the subject, I had forgotten the circumstance of my having been in conversation with several monied gentlemen in the City in 1831, who proposed to form themselves into a company at that time. In consequence of Sir Charles's stoppage, and in consequence of the tolls, they said they would not proceed, for they doubted whether they would be able to obtain an Act of incorporation, seeing the disposition of Parliament manifested in passing those tolls. I did not recollect this at the time when I was examined yesterday.

1122. Can you give the Committee any other instances of injury to Mr. Gurney or to his steam carriage, resulting from the imposition of those heavy tolls?—I think what I have already stated may be considered a sufficient answer to that question. I am not aware that I can give any additional information on this point.

1123. Are practical engineers the best persons for introducing this subject?—Not, in my opinion, as a body.

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1124. Why?—Because they bring their old rules of construction to bear upon a new subject, where those rules will not apply at all. The points which Mr. Gurney has been so particular about, those of circulation and separation for instance, are not admitted by the body of engineers at all, and they are, with very few exceptions, inclined still to introduce boilers of a large capacity. If they do so, some serious accidents must be the consequence, because there is no plan hitherto devised whereby they can make boilers, which have to undergo such changes, perfectly stable; they ought to provide for their bursting, and the provision of course should be, that when a boiler does burst, the least harm may result. That can only be obtained by having a boiler of very small chambers.

1125. Do you consider the boiler without a separator to be safe for steam carriages?—If made of small chambers, the boiler may be safe; but if the chambers are increased in size, and if those chambers are not circular, they will be more apt to burst. The accident I alluded to yesterday, and which happened to Mr. Hancock's boiler, is, I think, to be attributed mainly to the bad state of separation.

1126. Do you think the separator an essential part of Mr. Gurney's invention?—A separator, or a mode of separation, is absolutely necessary in every boiler. The best illustration of this, and one which I have lately printed, and which will be published in a few days, I would give to the Committee. Intensely heated water is similar to soda water in a bottle: the steam is held in solution by the water, just as carbonic acid (gas) is held in solution in soda water; apply a warm hand to the soda bottle, and start the cork, and you may (even when you keep the bottle in a vertical position) drive all the liquid out in froth. The same thing happens in a steam boiler of small capacity, if separation be not attended to.

1127. Has Mr. Hancock's engine a separator?—He has no distinct vessel for separation.

1128. Do you think it would be dangerous without that?—I attribute the accident already mentioned mainly, if not entirely, to his want of separation. There is a little due to the large surface of the sides of his chambers, which not being circular or cylindrical, are not so well adapted for resisting pressure as the boilers of others are; but I think the origin of the evil was in there not being a sufficient separation.

1129. You stated that the prohibitory tolls were the cause of Mr. Gurney's carriages not proceeding?—I stated that such was my impression, and that such impression has been made in my mind by conversation with numerous parties, and, I may say, particularly with Sir Charles Dance, and from what he stated in the Institution of Engineers. This I alluded to in evidence yesterday.

1130. Do you think if these prohibitory tolls had not interfered with Mr. Gurney's proceedings, Mr. Hancock's carriages could have stood the competition of Mr. Gurney's?—I do not entertain so good an opinion of Mr. Hancock's boiler, and of its value as a mechanical structure, as I do of Mr. Gurney's.

1131. Do you think it is a modification of Mr. Gurney's principle?—No, I cannot say that, and I should be sorry that my evidence yesterday should be construed in such a way, that I might ever be said to have represented Mr. Hancock's boiler as, in any way, a modification of Mr. Gurney's patent; I do not mean my evidence to be such.

1132. Did Mr. Gurney's first experiments go to remove an opinion common amongst engineers as to the extent of surface necessary to produce a certain power in boilers?—It was a prevailing opinion with engineers, and it is the prevailing opinion with a great body of engineers at the present day, that there must be a considerable surface for every horse power; I am not sure what that surface is in Bolton & Watt's engines; it may be sixteen or seventeen square feet per horse power; I mean, surface for the transmission of the heat to the water, and they allow twenty-five cubic feet of *space* per horse power. In high-pressure engines, it is about nine or ten feet surface per horse power; in some cases it may be less than ten, but generally ten square feet of surface for transmission of the heat. Now Mr. Gurney produced the same effect by a more intense heat on a smaller surface: by the smallness of his chambers he was enabled to use thinner metal, and consequently the transmission of heat to the water was more rapid, through the thinner metal, than it would be through the thicker

thicker metal; hence a smaller surface for transmission answered the same purpose as the larger surface did in the former case.

1133. Do you consider that the change in regard to the extent of surface, and in regard to the intensity of fire, produced the effect of locomotion upon common roads?—That, together with the construction of a boiler which held a small quantity of water, produced the effect.

1134. Do those improvements enable such a boiler to be constructed?—Certainly.

1135. Have all the boilers that have been applied to locomotive engines upon common roads since that period, been constructed with a view to those points?—Few boilers have been constructed with a view to the employment of a small heating surface; very few of them with a view to having small chambers for carrying a small quantity of water.

1136. Is the data of horse power, as far as surface and power are concerned, generally fixed by engineers?—It is generally laid down, as I have just stated it, to be some sixteen or seventeen square feet for the transmission of heat for each horse power in a low-pressure boiler, and nine or ten square feet for the transmission of heat in high-pressure boilers per horse power.

1137. Did Mr. Gurney change that data?—Mr. Gurney has; he never required any thing like that extent of surface. I may state, that Mr. Gurney has introduced the lightest boiler yet invented, and I believe with a hundred weight of boiler he will evaporate more water than any other person can do with as great safety by any other means.

1138. Did he show that extent of surface was not so necessary as the quality of the surface?—The old rules by which engine-makers worked were such as required a large surface for the transmission of a certain quantity of heat to the water, for evaporation of a certain quantity of water. Mr. Gurney, as I have already stated, used a smaller surface, and evaporated the same quantity by the more rapid transmission of heat through that small surface. This was an improvement in the quantity of surface.

1139. Do you think that the success of steam carriages upon roads materially depends upon those principles suggested by Mr. Gurney?—I consider that without them steam carriages would have been in the same state that Mr. Gurney found them in. I think Mr. Gurney showed the road to improvement in boiler-making, so far as levity was a desideratum.

1140. In fact it is your opinion, that the merit of the invention of steam carriages running upon roads is entirely due to Mr. Gurney?—Without Mr. Gurney's invention, steam carriages would not now have been running upon common roads, unless some other person had stepped into his shoes, and acted upon the same principles.

1141. Have you had any reason to alter the opinions which you expressed before the Select Committee of the House of Commons in 1831?—No; I am still of the same opinion.

1142. You stated that you did not conceive the boiler of Mr. Hancock to be on the same principle as the boiler of Mr. Gurney; does not the boiler of Mr. Hancock depend upon an increase of surface in a very small compass instead of tubes?—That question involves the consideration of Mr. Gurney's specification. I consider Mr. Gurney's patent to be principally for the circulation and separation. Mr. Hancock has certainly the facility of transmitting a certain quantity of heat through a small surface; he has not arrived at it by the same form which Mr. Gurney has patented.

1143. He has adopted another mode of getting at the same principle?—He has adopted a small surface, and so did Mr. Gurney before him; Mr. Gurney knew, that, having so small an apparatus, he must have a perfect circulation; and a perfect circulation Mr. Hancock does not seem to have obtained.

1144. Do you think that Mr. Hancock's mode of obtaining this principle is more defective than Mr. Gurney's?—Certainly; for reasons just given.

1145. Do you think it a mode of escaping from the invasion of his patent?—I do not at all think it is done with that view.

1146. As a practical man, do you think that if there had been no legal objection to the adoption of Mr. Gurney's mode of separation and circulation, he would have gone out of his way to obtain any other mode?—It is so difficult to convince men of what is the best course to take, that I am not sure Mr. Hancock or any other person would be convinced that Mr. Gurney's was the better

plan.

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plan. Now, were Mr. Gurney's patent thrown open, it is likely, I think, that a very short time would induce steam-carriage builders to change from the one system to the other.

1147. Supposing Mr. Gurney's patent to have been opened when Mr. Hancock first tried his experiment on steam carriages, do you think, at that time, before Mr. Hancock adopted his present plan, he would have gone out of his way to adopt any other mode than Mr. Gurney's?—Supposing Mr. Hancock's, or any other person's object was to make a perfect engine, or an engine as nearly so as possible, they might perhaps have adopted Mr. Gurney's principle, if their eyes had been open to the importance of it; it is just possible that there are other considerations which induce men to take out patents. Being a patent agent, I know very well that the bare circumstance of their being styled patentees is of service to some men. I do not say, that it is to any of the persons whose names I have mentioned. I presume the Committee have mentioned Mr. Hancock as one of many in the field of locomotion.

1148. Have you any thing more which you wish to state?—I do not know that this is the proper place for me to state, that if any legislative enactment is about to be introduced, I consider that some clause will be necessary to prevent the serious accidents which must attend any attempts to introduce large-chambered boilers upon crowded thoroughfares. There is no means yet devised which can secure persons from accident, if a large-chambered boiler be suffered to be introduced.

1149. Those large-chamber boilers do not apply to Mr. Gurney's patent?—No; Mr. Gurney's present boiler, or any of his that I have seen, are differently constructed. I even think Mr. Gurney should be limited in the size of his separators. He has not yet exceeded what may be considered security. It was stated to the last Select Committee upon Steam Carriages, in 1831, by Mr. Farey, a very good authority, in effect, that no accident could happen from Mr. Hancock's boiler. Now, an accident has happened, attended with loss of life, resulting from the incautious use of that boiler. I know it is contended by a number of engineers, that that accident would not have happened had Mr. Hancock's safety valve not been fastened down by a piece of wire, as it is said to have been. Several circumstances have induced me to believe, that the explosion was of a nature which could not be prevented by a safety valve.

1150. Do you consider that it is at all necessary, in Mr. Gurney's arrangement, to increase the size of the vessels, so as to give no chance of danger?—It is not necessary; but there is no saying what experimentalists may do.

1151. Do your objections to Mr. Hancock's boiler apply to Mr. Gurney's boiler as now constituted?—Not as now constituted.

1152. Or as you have ever seen them constituted?—I think I once saw a boiler of Mr. Gurney's,—where it went I do not know,—which was not quite safe; and I have reason to believe that Mr. Gurney has abandoned such construction.

1153. Do you conceive that there would be any advantage to Mr. Gurney, provided he were to use a larger boiler than you consider safe?—I do not think that he would gain advantage by having larger chambers than he has now; his tubes might be increased in diameter with advantage to the circulation; but the chambers of separation, which are the large part of his boilers, need not be made any larger.

1154. All you wish for is, that there should be public protection with respect to those boilers, so as to keep Mr. Gurney to his machinery as it is at present constructed, and with respect to these chambers?—So as to keep Mr. Gurney and other manufacturers within certain limits.

1155. You do not think that Mr. Gurney's chambers are too large now, but you would object to their being made any larger?—I should not like their being made much larger. Mr. Roberts, of Manchester, who is decidedly one of the best mechanics in Europe, lately built a steam carriage, and after it had run a few miles, it blew up in the streets of Manchester. It had a boiler with large chambers. That no accident has happened upon the Liverpool and Manchester railway from the large boilers that are there used, must be attributed to the structure of the flue tubes, which burst and let out the water. These flue tubes do in fact form so many safety valves. The directors complain of the expense of repairing these tubes; and every means for strengthening them or for making them more durable is resorted to. The directors may, however,

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go on strengthening them so much, that they cannot burst in this way. Then accident from the sides of the boiler may be looked for.

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1156. Do the steam engines upon rail-roads require the change in the extent of pressure required on the common road?—No, they do not. Upon the Liverpool and Manchester line, for instance, they do not; and I do not expect to see rails laid down upon such undulating roads as would require great variation of pressure. Upon the turnpike road there is great variation of pressure required.

1157. Do you think in consequence of various parties using those large boilers in steam carriages which they have adopted on roads, it would be a benefit to the public that Mr. Gurney's patent should be thrown open?—It would, in my opinion, advance the subject, and thereby benefit the public; as I consider that the benefits to accrue to every branch of society from the introduction of steam carriages are very extensive.

1158. Do you think that the safety of the public would be increased thereby?—Yes.

1159. In consequence of their using better steam carriages than those which are now built, for fear of the invasion of Mr. Gurney's patent?—I certainly think the throwing open of Mr. Gurney's patent would be very effectual for promoting the safety and economy of steam carriage conveyance.

1160. Are you acquainted with any other parties than Mr. Hancock, who are now running steam carriages upon any roads?—I had a letter a few weeks ago from Mr. Russell, who is running steam carriages between Glasgow and Paisley, and also a plan of his carriage. I believe he is now running again after a short stoppage.

1161. What carriage is he running?—A carriage of his own construction; but I cannot say that I am perfectly acquainted with it.

1162. Does it approach at all to Mr. Gurney's principle?—I know so little of it, that I cannot speak to that point.

1163. Do you understand that it is running with a profit?—I do not know. Mr. Russell wrote an article upon the subject of inland transport in the Foreign Quarterly Review; he is a gentleman who was appointed to lecture from Professor Leslie's chair after Sir John Leslie died, and until a new professor was elected. At this time he wrote the article in the Foreign Quarterly Review, stating that nothing yet had been done in steam carriage conveyance, and that every attempt hitherto made had totally and absolutely failed; and then he began upon a new plan of his own.

1164. Did he say in that review, that springs were very essential to carriages?—Yes.

1165. Did he not say that Mr. Gurney's carriage had no springs?—I do not recollect whether he said so.

1166. Do you know of your own knowledge, whether Mr. Gurney's carriage has been fitted up with springs from the first experiment?—I have never seen any of Mr. Gurney's carriages without springs; I have seen, I may say, the whole of Mr. Gurney's principal experiments from the first. I ought to state with regard to Mr. Russell's opinions upon steam carriages, as expressed in the Foreign Quarterly Review, that I believe very few practical men will give him any great measure of credit for understanding the subject upon which he wrote at that time.

1167. You do not know practically of what nature his engine was?—I do not know his present construction so well, as to give any evidence thereon.

1168. Are you aware whether there are any tolls on the roads upon which he is running?—I do not know of any oppressive tolls.

1169. Can you mention any others who are engaged in steam carriages?—Mr. Ogle and some others.

1170. Is he running now?—Not at present.

1171. Do you know why he is not running?—I do not know; I never considered Mr. Ogle's carriage so perfect as others have done.

1172. Do you know whether Mr. Russell's carriage is a steam tug?—It carries passengers upon the engine, and it has a small curricule-shaped carriage attached behind. I know also Mr. Squire and Colonel Macerone's carriages, very intimately.

1173. Are those running?—They were a week or ten days ago.

1174. Are they running for profit?—They were running a carriage as a public

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public demonstration and advertisement, with a view to get orders for building carriages.

1175. Are you aware whether any orders have been given to them?—There is one carriage now being built for Germany at their factory.

1176. Do you know Mr. Squires?—Yes.

1177. How long have you known him?—I have not known Mr. Squires more than eighteen months. Mr. Squires has formerly been employed in Mr. Gurney's manufactory, but I cannot remember of having conversed with him at that time.

1178. Do you know in what capacity he was there?—Millwright or carpenter.

1179. Do you know whether Mr. Gurney had him up from the country?—No, I do not.

1180. Do you know whether Colonel Macerone was in the habit of going to Mr. Gurney's manufactory?—I have seen Colonel Macerone at Mr. Gurney's factory; it must be six or seven years ago.

1181. Had he experiments in Mr. Gurney's factory?—I do not know what experiments he was carrying on; but I believe he was carrying on some experiments on Mr. Gurney's premises.

1182. What was the nature of those experiments?—I do not know.

1183. Were they connected with steam carriages?—I have been led to think they were connected with Pneumatics, but that is only from hearsay.

1184. Do you know Dr. Church's carriage?—I have examined it and know it.

1185. Is that running now?—No.

1186. Why is it not running?—I can scarcely answer that question; unless he has made considerable improvements since I saw it in October, his boiler is very defective still; his circulation is imperfect.

1187. Has he ever endeavoured to run it for profit?—He has not yet brought it out for hire; but he has had it out. It is altogether too large a machine to run upon a turnpike road; it is more like a very large and wide van than an ordinary carriage.

1188. Sharpe & Roberts, you say, have failed on account of the boiler bursting?—Yes.

1189. Has it been running since that?—I heard last night from a gentleman who has just returned from Manchester, that Sharpe & Roberts had put, or were about to put one upon the Manchester and Liverpool line of railway, but that is all that I know about its operations.

1190. Do you know any thing of Heaton of Birmingham, and the structure of his steam engine?—Mr. Heaton of Birmingham built a steam carriage with a boiler very similar to those now in use upon the Liverpool and Manchester railway; he has discontinued his operations lately, but I do not know from what cause; I believe there is a good reason.

1191. Do you think that he would have gone on in opposition to the tolls that had been imposed if other difficulties had not occurred?—The neighbourhood of Birmingham being one where machinery is favourably regarded, is particularly well adapted for the introduction of steam carriages, and Mr. Heaton would consequently have advantages which in the neighbourhood of London or in the neighbourhood of a great watering place, such as Cheltenham, or in a great agricultural district, no one could have had. I never had any conversation with Mr. Heaton, except as to the construction of his carriage, and that was at his own factory. Tolls were not mentioned.

1192. Did the construction of his carriage at all approximate to that of Mr. Gurney?—No; the boiler was of a large capacity, and he had not attempted any of the essential points excepting levity.

1193. Do you think that his experiment would have been either dangerous or unsuccessful if it had been carried on?—I should be afraid of the boiler bursting. He proved in that neighbourhood what Mr. Gurney had proved at Windmill Hill and at Old Highgate Hill, and at various other hills years ago, that the ascent of one in eight could be accomplished by steam carriages.

1194. When did he commence his experiment?—Not publicly, more than twelve months ago; his public exhibition was in the summer of 1833. He then ascended Broomsgrove Leky hill.

1195. Do you know Maudsley's & Field's steam carriage?—Yes; there are two

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two steam carriages now constructing at that factory; one of them is upon Mr. Joseph Maudsley's plan, the other is upon Mr. Field's and Sir Charles Dance's plan; Mr. Maudsley's boiler consists of several horizontal concentric cylinders of water and flue space alternately. Mr. Field's and Sir Charles Dance's is the other carriage, and it is a modification of Mr. Gurney's boiler without the separators.

1196. Are the tubes wider?—I believe the tubes are two inches in diameter.

1197. What was the width of the tubes in Mr. Gurney's boiler?—About an inch, internal measurement; I had four of Mr. Gurney's boilers under my management, as an engineer, for purposes not connected with his carriage, and their tubes were about one inch in diameter.

1198. Do you know Mr. Gibbs's carriage?—I have seen Mr. Gibbs's carriage in 1832.

1199. What do you think of that?—The circulation was very imperfect; and there was a liability to burn out the top of his fire-place.

1200. Is he running now?—No; but he is making private experiments with a new boiler.

1201. Do you know why he gave it up?—I do not know all his reasons.

1202. The parties that have been mentioned to you are some of them trying experiments, and one or two of them about to run on common roads; can you at all explain why they should be willing to run, and the subject should be coming apparently into operation, when Mr. Gurney was stopped in the year 1831?—The eyes of the public are more open to the importance of the subject, and the anticipated valuable results to society.

1203. Do you think the disposition of the public now being more towards steam carriages, and those experiments that have been lately tried, and the preparation which is made by some parties to run upon common roads, are any proof that the prohibitory tolls did not impede the progress of Mr. Gurney in 1831?—I do not consider these to be any proof that Mr. Gurney's progress was not impeded by the prohibitory tolls in 1831; the public mind has entirely changed since that time, because it is better informed upon the subject. The attempts of numerous builders of steam carriages are to be attributed to that desire for speculation which many men have; I do not expect any happy results from many that I could name, but whom I should not wish to name.

1204. Do you think that the public have more confidence now that Parliament will not impose any more prohibitory tolls, and that they will take off the prohibitory tolls which now exist upon steam carriages?—I have no doubt that the very circumstance of this Committee having investigated the matter will make a favourable impression upon the public mind, but how far that may go to enliven it after being so damped, I do not know.

1205. You have stated within the last six or eight months the public mind has undergone a great change in favour of Mr. Gurney's carriage?—The great advantages which must result to society from the introduction of steam carriages upon turnpike roads, for cheapening and accelerating conveyance, by non-consumers of food especially, have been made more apparent. I doubt not Mr. Gurney, as the demonstrator of steam carriage practicability, and as the successful inventor, will therefore be favourably regarded; but I do not think that Mr. Gurney's name has had any thing to do with that particular change in the moral feelings of the country. He overcame the physical difficulties, and his carriage may be more favourably regarded.

1206. Do you think that the parties who are making experiments are at all looking forward to the expiration of Mr. Gurney's patent, when they can with greater facility carry on any experiments that they think proper?—I should be very glad, were I building steam carriages, to be allowed to construct boilers upon Mr. Gurney's principle, without paying him any patent rights. I do not know that other people may hold the same opinions.

1207. Do you think it has been the cause of the greater speculation in carriages in the last year that the expiration of Mr. Gurney's patent is approaching, when they will be free from any restrictions?—I am at a loss to know how to answer that question, as I am not acquainted with their views of Mr. Gurney's patent.

1208. Is it your opinion that the experiments that have lately taken place, or may be now taking place, with respect to steam carriages, are no proof that

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sufficient obstacles did not exist to Mr. Gurney's going on in 1831?—Certainly they are no proof.

1209. You still remain of the same opinion, that sufficient obstacles did exist in 1831, in consequence of prohibitory tolls, to induce Mr. Gurney and others with him to abandon the subject?—My opinion remains unshaken upon that subject.

Martis, 15^o die Julii, 1834.

SIR WILLIAM MOLESWORTH, BARONET,
IN THE CHAIR.

Mr. William Poole, called in ; and Examined.

Mr. W. Poole.

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1210. DO you attend from the Patent Office?—I do.

1211. Will you be good enough to state the date of the first patent of Mr. Gurney upon steam carriages?—The 14th of May 1825.

1212. For what purpose?—For “Apparatus for propelling carriages on common roads or on railways.”

1213. Will you state the second?—October the 21st, 1825; “For certain improvements in the apparatus for raising or generating steam.”

1214. What is the third?—The third is October 11th, 1827; “For certain improvements on locomotive engines and apparatus connected therewith;” and the 4th is July 8th, 1829, “For certain improvements in the apparatus for raising or generating steam, and currents of air, and for the application thereof to locomotive engines and other purposes.”

1215. Do any of those extend further than to England?—The one in October 21st, 1825, was for England and Scotland; that was the only one that extended beyond England.

1216. Have you the date of any patent from Mr. Hancock?—Yes, in 1825.

1217. What is the title?—I have not the title with me, I have merely the dates.

1218. Is that in relation to steam carriages or boilers?—They all relate to steam carriages.

1219. Have you any patent from Dr. Church?—Yes, two, in 1831 and 1833; there is one in each year.

1220. Have you any patent of Messrs. Sharpe & Roberts?—I have not the date of that.

1221. Have you any of Macerone?—That was in 1833, dated the 18th of July.

1222. Heaton?—That was in 1830, 23d of November.

1223. Russell?—The patent of Russell is just past, I have it not in my book.

1224. Ogle?—Summers & Ogle was the 14th of April 1831.

1225. Sir Charles Dance's?—Sir Charles Dance's patent, in his own name, was the 21st of February 1833.

1226. Maudsley?—The 7th of October 1833.

1227. Gibbs?—The 25th of September 1832.

1228. Field?—The patent is Sir Charles Dance's and Field.

1229. Was there one patent or two?—Only one, I think.

1230. All those refer to steam carriages?—Yes.

1231. What is the expense of a patent for the United Kingdom?—Three hundred and sixty pounds for England, Ireland and Scotland.

MINUTES OF EVIDENCE
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REPORT

FROM

SELECT COMMITTEE

ON

ARTS AND MANUFACTURES:

TOGETHER WITH

THE MINUTES OF EVIDENCE,

AND APPENDIX.

Ordered, by The House of Commons, to be Printed,

4 September 1835.

Martis, 14^o die Julii, 1835.

Ordered,

THAT a Select Committee be appointed to inquire into the best means of extending a knowledge of the Arts and of the Principles of Design among the People (especially the Manufacturing Population) of the Country; also to inquire into the constitution, management and effects of Institutions connected with the Arts:—And a Committee was appointed of—

Mr. Ewart.	Mr. Roebuck.
Mr. Bernal.	Lord John Russell.
Dr. Bowring.	Mr. Patrick Stewart.
Mr. Ridley Colborne.	Mr. Strutt.
Mr. Clay.	Mr. Poulett Thomson.
Lord Francis Egerton.	Mr. Warburton.
Mr. Elphinstone.	Mr. Morrison.
Mr. Grote.	Sir Robert Inglis.
Mr. Hawes.	Mr. Wyse.
Mr. Hume.	Mr. Scholefield.
The Lord Advocate.	Mr. Edward Lytton Bulwer.
Mr. Lewis.	Mr. Henry Lytton Bulwer.
Mr. Oswald.	Earl of Kerry.
Sir Robert Peel.	Lord Viscount Mahon.
Mr. O'Connell.	Mr. Yorke.
Mr. Shiel.	Mr. Heathcote (of Tiverton.)
Lord Viscount Sandon.	Mr. Baines.
Mr. Chancellor of the Exchequer.	Mr. Stewart Mackenzie.
Sir Matthew White Ridley.	Mr. Williams (of Coventry.)
Mr. Brotherton.	Mr. Fort.
Mr. Potter.	Mr. Davenport.
Mr. George Evans.	

Ordered, That the Committee have power to send for Persons, Papers and Records.

Ordered, That Five be the Quorum of the Committee.

Mercurii, 22^o die Julii, 1835.

Ordered, That Mr. Wilks, Mr. Hanbury Tracy, Mr. Buckingham and Mr. Hope be added to the Committee.

Veneris, 7^o die Augusti, 1835.

Ordered, That Mr. Brocklehurst and Mr. Jephson be added to the Committee.

Veneris, 4^o die Septembris, 1835.

Ordered, That the Committee have power to report the Minutes of the Evidence taken before them.

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Mortis, 14. die Julii, 1835.

R E P O R T.

THE SELECT COMMITTEE appointed to inquire into the best means of extending a knowledge of the **ARTS**, and of the **PRINCIPLES** of **DESIGN** among the People (especially the Manufacturing Population) of the Country; also to inquire into the Constitution, Management and Effects of Institutions connected with the Arts; and to whom the Petitions of Artists and Admirers of the Fine Arts, and of several Members of the Society of British Artists, were severally referred; and who were empowered to report the **MINUTES** of the **EVIDENCE** taken before them to **The House**:—**HAVE** examined the matters to them referred, and have agreed to the following **REPORT**.

THE COMMITTEE began its labours by dividing the subject of inquiry into the following parts:

THE state of Art in this country and in other countries, as manifested in their different manufactures.

THE best means of extending among the People, especially the Manufacturing Classes, a knowledge of and a taste for Art.

THE state of the higher branches of Art, and the best mode of advancing them.

The investigations of the Committee have been principally confined to the first and second sub-divisions of the subject.

The Committee lay the Evidence hitherto taken before The House, and recommend the resumption of the inquiry early in the next Session of Parliament.

September 1835.

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MINUTES OF EVIDENCE.

Lunæ, 27^o die Julii, 1835.

WILLIAM EWART, ESQUIRE, IN THE CHAIR.

Dr. *Gustave Friedrick Waagen*, called in; and Examined.

1. YOU are the Director of the Royal Gallery at Berlin?—I am.

Dr. G. F. Waagen.

2. What institutions have you in Prussia for the instruction of the manufacturing population in the Fine Arts?—We have a *Gewerb-Institut* at Berlin for the purpose of giving instruction in manufactures connected with the Arts.

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3. Have you one, or more than one?—That is the principal one; we have smaller institutions, but these are merely schools of design, in Breslau, Konigsberg, Dantzic and Cologne.

4. How many are there altogether in Prussia?—There are five; there is the principal institution at Berlin, and the four smaller institutions.

5. Can you give the Committee any account of the schools of design in the other states of Germany generally?—If by this question is meant *Gewerbe-schools*, then I cannot.

6. Do such schools exist in other parts; for instance, in Saxony and Bavaria?—I believe *Gewerbe-schools* do not; there is a Royal Academy, where young men that learn manufactures at Dresden may attend.

7. Can you give the Committee any account of the management of those *Gewerbe-schools* in Prussia?—At Berlin, in the chief *Institut*, there is a collection of models representing the newest discoveries in Europe, and particularly in England; there is also a very complete collection of the finest ornaments and designs of the Greek and Roman and middle ages in plaster of Paris; also some of the most distinguished works of naked sculpture, especially the pure Grecian; the pupils there are also instructed in drawing, modelling, in mathematics and perspective; each one chooses his own department of manufacture; they are taught also the founding and casting of metal works and other manufacturing operations.

8. Is the instruction of those schools gratuitous?—Yes, the instruction is gratis.

9. Are those schools under the government?—They are entirely under the government, and the managers are paid by the government.

10. Is the whole expense of the institution defrayed by the government?—The whole is paid by the government.

11. Does that apply to the minor schools in the other towns, as well as the principal school at Berlin?—Yes.

12. Can you state the expense of those schools?—I cannot state it now, but I can easily procure an account, and I will do so. The whole of the establishment is under a director, whose name at present is *Beuth*, privy councillor of Finance, who has the management of the whole establishment.

13. Is chemistry among the subjects taught in the school?—Yes, there is instruction given in chemistry.

Dr. G. F. Waagen.

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14. Is any branch of experimental philosophy taught?—Partially; there is some instruction given in natural history and physiology, and they have also electrical and other machines in the schools.

15. Are there any other arts and sciences taught in the schools?—I have mentioned all the most important branches.

16. How are the pupils elected into those institutions?—The pupils are recommended from the provinces by the *Government-president*, and sent to Berlin. They must have a knowledge of some manufacture; they must be able to read and calculate, in order to be received into the institution. If those young people do not show any aptitude after being some time, the institution is not compelled to continue the instruction to them; but they are sent back to the places whence they came.

17. Are they lodged and boarded in the institution?—No; they receive the instruction freely, but they must pay for their own board and lodging in Berlin.

18. Out of what classes are they selected by the government presidents?—There is no particular class of society out of which they are peculiarly chosen; when any individual is considered to show particular aptitude, no further inquiries are made, but that is considered a sufficient qualification.

19. Who makes the selection?—Any body may recommend any young man who has a taste for a particular branch of art to the president.

20. Do you know the mode adopted by the *Government-president* before he gives his certificate?—No, I do not.

21. What are the regulations as to the age of the pupils?—They cannot be received above, but may be received under the age of 16.

22. Are they then sent immediately to Berlin, or are they kept any time in the provincial schools?—They are sent to Berlin.

23. Is the same system pursued with respect to the minor schools at Breslau and Königsberg, and other places?—Those are preparatory schools, merely of design, where they do not undergo so strict an examination.

24. Are those who are sent to Berlin sometimes selected out of the provincial schools?—Sometimes they are, and sometimes not.

25. And sometimes they finish their education at the provincial school without going to Berlin?—When they do not want to take a very high path in art, they content themselves with more elementary instruction in the provincial schools. The Berlin institution is supplied with pupils not only from the minor schools, but selected by the government president from the mass of the population, as well as from the other schools.

26. How long do the students stay in the Berlin school after they have been admitted there?—I do not know whether it is two or three years.

27. How many students are there in the Berlin institution altogether?—The number is not positively fixed.

28. Can you state about how many there are?—I do not think the number in the principal school exceeds from 80 to 100.

29. Is the period which the pupil stays in the school determined by his age or by his attainments?—It is according to a certain course which he has gone through.

30. Can you state the number of scholars there are in the provincial schools altogether?—That is quite uncertain; the number of students in the inferior schools is much more uncertain and fluctuating than those in the principal school at Berlin, inasmuch as the quantity of instruction communicated is so much less.

31. Are those pupils prepared for all sorts of manufacture, for silk and cotton and metallurgy?—Yes, for every description of manufacture.

32. The school applies its instruction to every manufacture with which art is in any way concerned?—Yes.

33. During what portions of the year do they attend the schools?—The courses extend through nearly the whole year; they begin at Easter.

34. What are the hours of attendance?—The business of the institution occupies the whole day, and they are very laboriously engaged.

35. Are there any periodical examinations of the students?—I cannot say; when they are finishing a particular course, a special examination takes place upon that course.

36. Are there any prizes distributed as a reward for merit?—When there is any particular instance of remarkable industry and remarkable success, he gets a distinction

distinction and a prize, and he sometimes gets as a reward some work of art produced in the school itself.

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37. In consequence of his attainments, is he recommended to any situation in any manufacturing establishment?—Yes; but it is quite natural, and it is the fact that where a pupil has distinguished himself in any particular manufacture in the *Gewerbe-school*, he goes to that part of the country where that class of manufacture is established, and meets with no difficulty in finding employment.

38. But he has no privilege in consequence of having gone through the school?—No.

39. Has he any title or diploma?—No.

40. Has he any certificate of having gone through the courses?—He has the ordinary certificate of attendance from the director of the institution.

41. Describing what branches he has studied?—Yes.

42. Do the certificates vary; for instance, supposing a man had particularly distinguished himself, does he get a different certificate from a man who had merely attended the lectures?—The certificates are more strongly expressed in that case.

43. Is there an annual examination before the king or the minister of instruction?—No.

44. How long have those schools been established?—I think about 20 years.

45. What has been the effect of those schools?—The spreading of those students through the provinces has improved the system of production, and the works they take with them have greatly tended to the improvement of the different manufactures of the country.

46. Has the cotton manufacture increased lately in Prussia to any great extent?—There has been a very great improvement in the cotton manufacture, particularly in the excellent patterns. The influence has not been confined to those who have come from the *Gewerbe-school* who have established manufactures, but other manufactures have been able to produce through that influence works of a higher and better character. The director *Beuth* has had a work printed at the expense of the government, with copper-plate engravings, which gives to the students most beautiful models of antiquity and the middle ages.

47. Are the patterns in the cotton printing the invention of the Germans, or are they principally copied from English or French?—The greater and better part of them are not patterns introduced from foreign countries, but are original designs made at Berlin.

48. Do the manufacturers ever send to the schools statements of what particular patterns they require to meet the public taste, so that the ingenuity of the school may be directed in the channel in which the demand is?—I could not say with certainty, but I know that a perpetual communication is kept up between the director of the institution and the principal manufacturers.

49. If a pupil intends to be a cotton manufacturer, does he turn to that branch of the art most connected with that manufacture?—Yes; the object of the institution is to unite beauty and taste with practicability and durability, and so to form the imagination and taste of the pupils as artists, by studying and drawing after beautiful models, that each may be enabled with facility to make discoveries in that branch which he particularly follows.

50. Is it the practice of the manufacturers to try the talents of the pupils in drawing patterns for any particular branch of art before they leave the institution; for instance, a calico-printer?—All the connexion which the institution has with the manufacturers out of doors is, that if a student should show a great aptitude for any particular branch, the director recommends him to the manufacturers in that particular branch.

51. Is instruction given in the composition of colours?—Yes; they study the mingling of colours.

52. Do the manufacturers apply to the school in order to get young men of talent for drawing patterns for any particular manufacture?—I do not know that, but I know that there is a great demand on the part of the manufacturers for pupils that excel in different departments.

53. Are any particular instructions given in the institution as to the preparation of colours?—Yes; that is one great point.

54. Are there any elementary courses which all the students attend?—Yes; they must all attend the drawing-school, and must all learn elementary mathematics.

55. Are you aware how long they continue in those elementary courses?—I think

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think that during the first year they are generally engaged in the common courses which are communicated to the whole body, and afterwards in the second and third years they pursue their own particular departments.

56. Is there any school of collection of patterns of manufactures?—There is; and it is the duty of the directors to collect from different countries the most remarkable specimens of patterns that are produced.

57. Are models of machines also collected?—Yes; they have a very large collection of models; for instance, they have models of different steam-engines, from their first production to the latest discoveries.

58. Do students come from Saxony to Berlin to attend the institution?—The principal object is to promote Prussian manufactures, and therefore only that portion of Saxony that is dependent upon Prussia enjoys the advantages of the institution.

59. Is there any similar institution in Saxony?—None of those institutions exist in Saxony; in the Saxon Academy the attention is more particularly directed to the higher branches of art, totally unconnected with manufactures.

60. Are there any libraries attached to those institutions?—Yes, there are, of general literature, and of all works relating to the objects of the institution.

61. Is there any botanical garden attached to it?—No; there is at the university one of the largest botanical gardens in the world.

62. And the botanical garden in the university would supply the institution with specimens?—Yes, certainly, if they are wanted.

63. Are there any anatomical courses in this institution?—Not in the *Gewerb-Institut*, but every pupil in the institution that wishes can go to the Royal Academy.

64. Do you know whether a portion of the instruction in the School of Arts is directed to the study of the human figure?—There is drawing after fine casts from the most famous antiques.

65. But they do not draw from the human figure itself?—No; but any one that wishes can go to the academy and draw after life.

66. Have the students in the *Gewerb-Institut* a right to attend the anatomical lectures without expense?—Yes, without expense.

67. Are the public lectures at Berlin open gratis?—In this institution, and in the Academy of Arts the lectures are open to every body gratis.

68. But not in the university?—No.

69. Therefore if a person wishes to study anatomy he must pay for it?—Yes; the anatomical lectures at the university, which are intended for the medical profession, are quite of another kind, and are not given gratis.

70. Is drawing from living models studied in the institution?—No.

71. Do they learn the proportions of the human figure in the institution?—Yes.

72. Have they any peculiar instruction in architecture?—Certainly they have, because they have models from the antique and the middle ages of all the most beautiful specimens of architecture; they have models of the Parthenon at Athens, and of the finest works of antiquity. There is besides an academy of architecture at Berlin, quite independent of the Academy of Arts, and of the *Gewerbeschule*.

73. Do they receive instruction with a view to the design of furniture?—Yes, every thing connected with household furniture in its widest extent, and the ornaments connected with it. They have models of the various forms of chairs, tables, tripods and every other domestic article. They have collected from every part small models in bronze, which represent all the most beautiful forms of antiquity for household furniture and ornaments.

74. Have those schools any connexion with the academy of Berlin?—No; but if the student shows any particular predilection for the higher branches of arts, he studies anatomy or the living figure in the academy; this is the only connexion between the academy and the school.

75. Is design in any degree made any part of the system of education in Prussia?—It is; drawing is taught in the national schools in Prussia; in the lowest popular schools there is some small portion of instruction in drawing given, and a large proportion in the gymnasia.

76. Has that a tendency to produce taste among the people by exercising the eye?—Certainly it has a tendency to exercise the eye of the people.

77. Do you think that for the encouragement of the arts among the people, drawing

drawing should form a portion of national education?—Certainly, I think that for education drawing is very useful. Dr. G. F. Waagen.

78. And you think it is of advantage for the propagation of the arts among the people?—I do. 27 July 1835.

79. Have you seen any considerable change in the character of the people produced by attention to those subjects?—We have not only seen great influence produced upon the people, but we have found among the people a great desire themselves to possess works of art.

80. What is the best mode, in your opinion, of applying arts to manufacture?—In former times the artists were more workmen, and the workmen were more artists, as in the time of Raphael, and it is very desirable to restore this happy connexion.

81. How would you restore it?—By giving the people an opportunity of seeing the most beautiful objects of art in the particular branch which they follow; by having collections of the most beautiful models of furniture and of different objects of manufacture. It is not enough however merely to form these collections; there must also be instructors to teach the people on what principles those models have been formed; furthermore, for the purpose of exercising the hand and the eye, it is useful that the young people should draw and model after those models.

82. What is the best mode, in your opinion, of extending taste and a knowledge of the fine arts among the people generally?—The best means of forming the taste of the people is by the establishment of accessible collections of the most remarkable monuments of antiquity and of the middle ages.

83. In what towns should such be founded?—In the capital of the country there should be the chief collection, but it is very injurious when all is centralized and confined within the capital; it is also useful, as is partly the case in France, and it is intended to be so in Prussia, to establish subordinate collections in the principal towns in the country. With respect to France, I myself have seen very admirable collections in Strasburgh, Rouen and Lyons.

84. According to what principles would you form those collections of art?—The principles upon which they should be established are the following: the monuments of the best periods, both of ancient and modern art which are too extensive and too costly to be possessed by private amateurs, should more especially be placed in a public collection, such, for example, as the Elgin marbles and the Egyptian remains in the British Museum; and such works of the best masters as both their size and their subject would prevent being received into private collections; therefore I think that a national gallery like that of England should be formed of pictures like the Sebastian del Piombo, the Parmegiano, the two Correggios bought from Lord Londonderry, and the Bacchus and Ariadne of Titian. It is most important that a national collection should start from this point, and be extended as much as possible in the direction of the other masters contemporary with Raphael, of whom there were many; for the works of such masters have a great influence in forming the taste in the best manner and in inculcating the best principles of the art; but in order to understand and still better appreciate the great masters, you must commence with those who immediately preceded them and who taught them.

85. Do you think that to produce other Raphaels they must go through the same process as Raphael himself went through?—Yes, and it is highly interesting to compare his paintings with the paintings of his master to see his progress. There should also be a few specimens of the earlier masters, and after giving a history of the early art and tracing it through the masters in the time of Raphael, I would follow it down through its declension during the last 300 years.

86. Will you state the manner in which you would arrange the works of art?—To arrange a public collection, it should be so formed as to combine taste with instruction; both are attained by an historical arrangement; such an arrangement, by following the spirit of the times and the genius of the artists, would produce an harmonious influence upon the mind of the spectator. The spectator would also, when he goes to the gallery, see the historical development of the art. For example, I consider the arrangement in the British Museum of the Elgin Marbles, and the Egyptian remains and other collections in separate rooms, as a good arrangement, which creates an uniformity of feeling with regard to the times at which they were produced. In respect to the superintendence of the gallery, I wish to make a distinction between that which is mere art, and that which is the literature of the art; there should be one professor to explain the historical

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literature of the art, and another to teach the practical application of the art; those collections can only propagate taste and art in a nation when every man can daily and hourly find free access to the collections of art; in Berlin the Museum is open on all days throughout the year except Sundays, from ten till four in the summer, and from ten till three in the winter; the holidays are about 10 or 12 in the year.

87. How many days are required for cleaning the Museum in the course of a year?—Every day after the people have left, the whole Museum is cleaned.

88. It is never closed for the purpose of being cleaned?—No.

89. Is it necessary, in order to enable the students to copy, to exclude the public?—At Berlin we never exclude the public for the purpose of accommodating the artists. We pursue the same course which is pursued in the famous gallery at Dresden, where the public are constantly present when the artists are at work, and the artists are completely accustomed to it.

90. In your opinion it is not necessary to exclude the public for the purpose of instructing the artists?—No.

91. What number of visitors have you at the Berlin gallery in the course of the year?—We have about 50,000; it is my opinion that the art is more advanced by the public generally seeing paintings than by the artists copying particular pictures. We find that in Dresden, where there is more copying than any other gallery, with good models before them, the art has very much declined, and we find that the artists themselves are not so much improved by copying as by attentively contemplating and studying the best masters. I feel a great objection to making art so completely imitative as that artists should be employed in copying pictures, and I think that art would be more advanced if they were made objects of general observation.

92. Do you think it is desirable that those galleries should be open on Sundays?—I should consider it advantageous if those collections were open on Sunday for a few hours; and I take the more interest upon this subject, because I am convinced that the days when the Museum is closed, namely, the Sundays and holidays, are the only periods when it is accessible to the working people. In addition to this, it is very important to have short catalogues with introductory remarks, giving a short history of the art, with remarks upon the objects exhibited, so that the spectator, when he enters, may not be quite ignorant of the subject; besides the large *Catalogue Raisonné*, I have a short catalogue with a few introductory pages, to instruct the visitors in the history of the objects they are going to see, and a critical account of the principal masters.

93. Would it not be a good plan to divide the National Gallery into compartments, according to the schools of the painters, and to put up the names and the dates of the painters?—Independently of the catalogues, I hang upon certain portions of the wall a little paper, containing the pictures in each division, with the name of the artist and subject of each picture, and the date, arranged under the head of the school. To apply those collections to proper purposes, it is desirable that there should be lectures upon the earlier down to more recent times of art.

94. Would you have them delivered in the gallery in the presence of the pictures?—No, that is not possible; but the teacher can refer to the pictures by the number. I think the National Gallery should have the power, when it received bequests of persons, to exchange or transfer them to the provincial galleries, and the power of selling, for the benefit of the gallery, any which might tend to degrade the taste.

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95. In what way, in your opinion, do you consider that the exercise of the fine arts in a country can be practically promoted?—By practical institutions for instruction for that special object.

When we consider the various methods by which the arts have been taught at different periods, we observe, from the 13th century downwards, at which time the fine arts awoke into new life, to the middle of the 16th century, and in many countries to the middle even of the 17th, the arts were taught after the manner of artizans, then very young, from the age of 10 to 12 years. The artist entered into the workshop of the master artist, and made himself, while quite young, master of the technical part of the art; and as he was permitted to behold works while under the hand of the master and his best scholars, he had a vivid conception of the art, and he had an opportunity, by seeing the practice, of turning it to the best account in the different branches, as, for example, drawing, painting, modelling
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and so forth. The master had an interest in the earlier attainment of knowledge in his scholar, as he expected assistance from him in his productions, and it was important to him to be able soon to entrust to him works of greater importance. When the scholar felt himself so much advanced that he could execute works of his own composition, he then quitted the workshop of his master in order to work on his own account. According to this simple mode of instruction, art is indebted for its greatest works. From such work-shops as these came forth masters, such as Leonardo da Vinci, Michael Angelo, Raffaello, Titian and Corregio. The great masters in the Netherlands school, Rubens, Rembrandt, Cuyp, Ruysdael, Hobbima, and so many others whose works every man of taste admires, were formed in the same way.

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Although already in the 16th century, there were several unions of artists, which bore the name of academies, the institutions of this kind in which art was taught as in modern academies, are not older than the middle of the 17th century; that at Paris was established by Louis XIV. in 1648. Most of the academies first rose in the course of the 18th century; they owed their origin to the endeavours of princes and artists to raise and renovate the sinking art. They thought that their object might be thus the more easily obtained, inasmuch as they abstracted certain rules from the works of former artists, and according to these rules instruction was imparted. That this instruction might be thoroughly imparted, they divided the instruction, so that drawing after the antique, drawing after the living model, anatomy, painting, perspective, and the laws of taste and composition, were each taught by different professors. In this manner it was believed that they could not fail to bring up most perfect artists.

The result did not answer the expectation, however thorough the instruction was in each of these divisions of the art. All these rules could not replace the intimate and personal relation between the old masters and their scholars, for in academies generally every professor believes he has done enough, according to the rules of art, when he has imparted his instructions, and does not feel himself induced to trouble himself about the progress of his pupil. We have even known instances in which the professor did not wish the pupil to be present at the time he himself was working. It is also injurious when the academies employ different professors to lecture the same pupils on the same subject, as, for instance, in drawing after the living model; for I have experienced that one professor has been of opinion that the pupil should copy the living model, even with all its faults, while another professor in so drawing would idealize and improve upon the form, or transpose the model into an universal scheme of his own; and each professor corrected the drawing of his pupil according to his own rules, by which means the pupil knew not which way to turn.

Instead of following the "mode of feeling" of a distinguished master, to which the pupil attached himself as to something living, until he was confirmed in the development of his own sentiment of art, in academies the cold general rule is substituted, which the young man is strictly bound to follow, according to the infallible direction of the professors, as the only correct method. In this manner, in the eighteenth century, a great number of works of very limited merit were produced, in which all academical rules of composition, drawing and *chiar'oscuro* were strictly observed, which, notwithstanding, appear only as well executed exercises, and leave the spectator cold, because they are wanting in the first and most indispensable attributes of works of art, namely the impress of the vivid individual feeling of the artist, which is the real soul of a work of art. If it possesses this "impress" of the artist's feeling, we overlook the possible defects in drawing and colour, as so many works of the ancient artists prove; when this "impress" is wanting, the most perfect acquirements in other degrees of art cannot replace it. The natural result of the academic institutions consequently was, that on comparing a number of specimens of the different schools, such as those in Paris, Petersburg and other places, all exhibited a striking similarity of manner, while in the earlier times and the earlier method of teaching, the character of the schools of different nations and that of each individual artist, was entirely original and distinct; as in the Dutch gardens, the different kind of trees were clipped to the same forms, so it was the case in academies with the different talents of different pupils. Would not any one feel a greater pleasure in the free growth of the trees in a forest, in preference to the monotonous uniformity of a Dutch garden? By this academic method, which deadened the natural talent, it is sufficiently explained why out of so great a number of academic pupils, so

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few distinguished painters have arisen. The three most distinguished artists which, for instance, Germany produced in the eighteenth century, namely, Mengs, Denner and Dietrich, owed their education not to academies, but were educated after the old manner. So, in our own days, the two most distinguished of the living artists of the German school, Cornelius and Overbeck, have risen to eminence in the most decided opposition to the academies; and the most eminent modern English artists, namely, Sir Joshua Reynolds, Barry, Wilson and Flaxman, did not receive their artistical education in an academy. That these men, when they were already celebrated artists, became members of academies, has nothing to do with the question, which is simply this, whether the academies have attained their objects as institutions of instruction. It must not, therefore, mislead us in favour of academies, that in our times a great many of the most celebrated artists have been members of academies; from the beginning, it must have been the interest of these academies by the reception of persons who enjoy a great reputation, to procure to the academies splendour and distinction, which otherwise would often have been wanting. With this, another injurious effect of the academies has been connected, by means of the official distinctions which the academies enjoy through the influence of the State. They have attained a preference over all the artists that do not belong to the academies, which the academies watch over very jealously, and have thus introduced into the freedom of art an unsalutary degree of authority and interference. It occurs often that a very *mediocre* artist, of which every academy counts some few among its many members, stands much higher in the State as an academician than the most talented artist who does not belong to an academy. As the majority of mankind look more on authority than on genuine merit, it has occurred often that a moderate artist being an academician has found plenty of employment, while artists of considerable talent who do not belong to such an institution, remain unemployed and unnoticed. If it is asked how the artists in modern times can be taught in a better manner, we may lay down the following remarks. The favourable relation in which the pupil stood to his master in the ancient times, might be restored in a certain degree by these means, that artists of distinguished reputation should be induced to open *studios*. Most artists would be induced to open studios if the Government provided them with the locality, and a moderate remuneration; besides this, every pupil would have to pay a moderate sum for the use of living models. How important such a system is for the formation of artists, may be seen in the example of Prussia; for sculpture, the studio of Professor Rauch, in which many distinguished artists have formed themselves in a good manner; and the most remarkable instance in painting is the school of Dusseldorf, which the Government founded under the direction of William Schadow eight years ago. Within this time several artists have distinguished themselves, who in originality and ability have surpassed all who for a long time have been formed in the academy at Berlin.

Together with these schools the academies can also continue to assist, in so far as thorough and uninterrupted instruction is given in anatomy, perspective and the history of art, for which instructions they are responsible to the State, and for which the State should give them some remuneration. Those branches of the art which are too expensive for the studio of the individual masters, might be pursued at the academy with the greatest advantage, by the students, under the direction of their own immediate masters.

The above method may be pursued with advantage by painters and sculptors, but the case is quite different with architects; architecture is divided into ornamental architecture, building in the water, military architecture, &c.; it is also connected with so many handicraft trades, as bricklayers, carpenters, and so on; it is in all these respects of such necessity and importance, that it is necessary to have a public institution in which all these subjects are thoroughly taught. The taste as well as the technical execution of buildings, might, by such institutions, combined with a collection of models, remarkably promote this branch of art. The connexion of a student in architecture with a certain master is of less importance than in the case of painting and sculpture. In this manner an institution of the kind exists in Berlin under the title of a *Bau-Academie*, or an architectural academy.

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96. Will Professor Waagen continue to express his opinion, which he obliged the Committee, with, on the subject of public exhibitions, and the means

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means of extending the knowledge of the arts among the people?—The second mode of distributing knowledge among the people would be by means of public exhibitions. It is in no case right that any man should be judge in his own case, and it is not advisable that a number of artists, who are about to exhibit their own works, should have the sole right to decide what works are to be admitted, and how other and different works of art are to be placed in the exhibition. In order to avoid all partiality, it would be effectual if the State was to appoint a Committee which should be composed of artists and connoisseurs of taste and judgment; and to make exhibition more generally accessible, it would be advisable to lower the entrance money from 1*s.* to 6*d.* It would not be advisable to make the exhibition gratuitous, as most persons bestow more attention on what they have paid for, than on what they see gratuitously. Out of the income derived from the exhibition, the members of the Committee are to be remunerated for their time and trouble, and premiums are to be awarded to the artists who contribute their works, according to their estimated value, upon which the Committee will have to decide; and as far as the artists who are members of the Committee have pictures in the exhibition, the other members not being artists shall fix their value, in doing which they will consult other distinguished artists not members of the Committee. These exhibitions are to be appointed by the State, not merely in London, but also for other towns of importance.

97. What other means do you think advisable as a powerful means of encouraging the exercise of the fine arts in this country?—Thirdly, by the purchase of the more distinguished works of art, works of art of distinguished merit, which the public have decided shall be purchased by the State, after the example of the Luxembourg Gallery at Paris, and collected in an especial locality as a national museum of British art. Similar collections of national art should be made in the other principal towns. It is one of the objects of the German Institution of art, called *Kunst Verein*, to assist less wealthy individuals in attaining possession of paintings and sculpture. In order therefore to admit the greater number of members, the annual subscription should be moderate, which even in London might be 2*l.* Out of the amount received by this means paintings and sculpture are bought by a Committee elected by the members from among their number by ballot, and then distributed to the members by a lottery. Of what advantage would be such a *Verein* may be shown by the example of those which were established in Berlin by a number of individuals about 10 years ago, under the patronage of the King, and the presidency of the Minister, Humboldt, which has had such success, that with an annual subscription of 15*s.* the annual income is now 1,200*l.*, by which means several meritorious artists find employment, and good works of art are spread over the country; and this *Verein* has given so much satisfaction that since then eight others on a smaller scale have been established in the provinces of Prussia. Further, in Bavaria, Saxony, Wurtemberg and Hanover, similar institutions have since arisen, by which the feeling for and an interest in the arts has been extended in an extraordinary degree in Germany.

98. What other means do you recommend for extending the produce of the fine arts?—Fourthly, by the employment of artists in public buildings, and although sculptors have been so repeatedly employed in the execution of public monuments, yet hitherto it has not been the case with painters; and thence we may trace the principal reason why England is so deficient in historical works of painting. The construction of the new Houses of Parliament would afford an honourable opportunity for it, and national art would produce a more respectable ornament in their walls than the most splendid and costly hangings. For several reasons fresco painting might herein be employed to advantage.

Mr. John Jobson Smith, called in; and Examined.

99. YOU come from Sheffield?—I do.

Mr. J. Jobson Smith.

100. What branch of manufacture do you particularly pursue?—Iron foundry, applied to ornaments.

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101. What is the name of your firm?—Stewart, Smith & Company.

102. Have you occasion to have models made to a great extent?—We expend about 1,500*l.* a year in the production of models of this kind for stoves and fenders alone.—[*The Witness produced a model of a stove front.*]

103. Are your models, some of them, very beautiful?—They are very beautiful.

104. Has Sir Francis Chantrey expressed any opinion upon them?—Sir Francis Chantrey

Mr. J. Jobson Smith. Chantrey has seen some of them, which he said were the finest specimens of iron manufacture which he had seen in the kingdom.

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105. In those works of art, how far is the inventor protected?—There is no protection at all; we have sent out such a thing as that on Monday morning, and it has been to Manchester, back again to Sheffield, and copied and returned to Manchester before Saturday night. The model which I am now speaking of cost us 50*l.* for men's labour.

106. Is the copy as good as your original work?—It is not; but they sell them so much cheaper, because they pay nothing for the production.

107. This of course is great injustice, and serious loss to the persons that invent the designs?—It is so great a loss, that we shall give up continuing it; I suppose that more than one-half of the patterns for stove-grates and fenders used in England have originated with us, but the piracy has come to such an extent, that unless there is some protection we must give it up altogether.

108. What would you suggest as a protection?—I should suggest some place, such as the National Gallery or Somerset House, where those things should be registered and some mark put upon it, such as the royal cipher or crown, denoting the registry, and a protection given for a certain time, three years perhaps.

109. Are you aware of the system by which patterns are protected in France?—I am not aware.

110. In the manufacturing towns of France there is a body consisting of one-half workmen and one-half masters, and to them the preservation of the patterns is confided by the law; the pattern is examined by this body, whose knowledge of the manufacture is sufficient to ascertain that it is original; the right of the presenter of it is recorded, with a given date, a small sum is paid for a protection for a certain number of years, and that record and the preservation of the pattern which is deposited in the hands of this body, enables him at once to enter legal proceedings against any pirater of the patent; do you think any such system of protection could be brought to bear in England, or can you suggest any better system of protection than that?—I should almost fancy that it would be impracticable in this country, because there is not such a location of the casting of iron.

111. Do you think a central board would answer the purpose?—I should think the object might be effected by a central board, where an actual cast of the original model might be deposited and registered, and left there a certain time for examination as to its originality, and the fact of its being registered might be proof of its originality after a certain time.

112. Would not the great difficulty be, that the persons who purloined patterns are ordinarily very inferior men, who could hardly repay the damage they have done?—It is not the case in articles of this kind, because there must be a considerable capital invested in the manufacture to produce it.

113. You think if you could verify the fact of your being the inventor, there would not be much difficulty in inflicting the penalty?—I think not.

114. You think it would not be worth the while of the inventor to go to the trouble and expense of registering unless the invention was worth protection?—No.

115. What are the class of artists that you employ for the production of patterns?—Some artists in London have been employed to make patterns for this description of goods. The young man that made this which I have produced has had no education in the art; he has studied from nature altogether, and this is a specimen of his production; he has risen so as to have the reputation of being the first in the trade.

116. Is he a person of considerable natural talent?—So much so that we have given him a share in the business on account of his natural talent.

117. Are those models drawn upon paper?—Yes; and if we were to confine ourselves to publishing them on paper, the law would give us a title to protection for them, but as soon as we bring them out in the form of a manufactured article we lose all right and title.

118. Are there several artists in Sheffield capable of producing such models as these?—There are several.

119. Have they increased of late years?—No.

120. Do they get tolerable wages?—They do not get very good wages, because the manufacturers in the neighbourhood so depend upon piracy, that they do

do not employ them; but if protection were afforded them, each manufacturer would be forced to employ an artist.

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121. You think that if art were better protected in this country, there would be a greater demand for beautiful designs?—There would, because the general taste is so much better than it was, that very superior things are now in demand.

122. To what do you attribute the improvement in the public taste?—I have sometimes attributed it to the fact of there being so many fine models in plaster for the external and internal decorations of rooms, by which means they have become better spread.

123. Do not you think that the opening of our intercourse with the continent has led to a great improvement in the national taste?—It has. French ornaments and French style have become introduced into this country, and become ingrafted into our own style.

124. Have you been able, notwithstanding the heavy duties upon this species of article, to export any to France?—No; we can send none to France; there have been some smuggled to France.

125. Do you think that the foreign models are superior or inferior to the English?—In this branch of manufacture I think they are inferior.

126. Are you aware that grates are not used in France?—They are used in France, I believe; they are porcelain grates very generally.

127. Are there persons employed at Sheffield to form those designs on paper?—No.

128. Have you attended to fenders as well as grates?—Yes.

129. Are the artists employed at Sheffield generally uneducated, or do they undergo some previous education in art?—They have had no education at all; it is a few men of natural talent, who have been accidentally directed to drawing very early, who have followed it up in this way.

130. Do you know any place in this country where a young man could obtain such knowledge?—No.

131. Have you a Mechanics' Institution at Sheffield?—We have.

132. Do not they instruct the young men gratuitously in design?—They have got several works of design, but there is no instruction given; those works however have been of great service.

133. Do you think it would be a good thing to extend the means of instruction in design among the people?—Certainly.

134. And especially to open collections of the best specimens?—Yes.

135. Have you often heard among artists a wish expressed that the knowledge of art should become more accessible to them?—Yes.

136. Do you know any class of persons in this country who are capable of teaching that kind of art to which you allude?—I am not aware that there are any except at very great expense.

137. Have the parties who draw those patterns been instructed at all in drawing?—Not at all.

138. And the state of the law is such that there is little encouragement to artists?—A capitalist will not purchase the higher order of talent, because no sooner does he produce it than it is stolen from him.

139. What can an artist obtain per week by devoting his time to the production of models in Sheffield?—About 3*l.* or 4*l.* if he is a clever man.

140. It is then the best paid labour?—It is.

141. How many artists do you suppose in Sheffield are solely employed in producing models?—Not above four.

142. Have they been all successful?—One of them has not been very successful.

143. Do not you think the public taste is so much improved that encouragement would be found for the production of articles more and more beautiful?—We find that we cannot produce articles too expensive for the public taste of the present day. Could we employ artists of a higher character, I am satisfied that the public would buy whatever was produced.

144. You think that cost would be no barrier to the sale of beautiful articles of art?—No; I should not myself hesitate in expending 200*l.* or 300*l.* in the production of a model for a grate to-morrow, if I had protection for it; but now it is certain that every thing worth pirating is pirated in three months; many things that are very good are pirated in 14 days after the time of their production.

145. As the taste is perpetually varying, how long would you conceive a sufficient protection to a pattern?—I think three years would be the least. The

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custom of the manufacturers of those things is to visit their correspondents once in six months, and it frequently happens that there is some reason for not having a new thing at the time, and it is frequently a twelvemonth before a pattern comes fairly before the public. I think we should have a fair protection for three years.

146. Unless you give rather a long period to the protection of a design, is not the effect of it to allow only a man of large capital to reap the advantage from the protection, because he only can put out a sufficient quantity of the pattern to remunerate himself?—Yes; every person to produce things of this kind must keep an extensive establishment about him. Besides the payment of the designer and the modeller, there must be workmen who get high wages after they have been designed and modelled.

147. Would the amount of capital employed in your business depend upon whether you had a protection for two years or three years?—No.

148. Does what you state apply, not only to your own line, but to all other lines in Sheffield?—Yes.

149. And more especially to steel and plated goods?—All the articles of plated goods that are stamped.

150. Have you conversed with persons whom you think most capable of judging of the propriety of legislative measures to protect such inventions?—I have.

151. Is the plan you have suggested of a Central Board the result of your inquiries among them?—It was my own opinion. I have not spoken to others respecting the details of the protection, but only generally; and I have the authority of Sir Francis Chantrey to say, that he decidedly coincides in my views, and he thinks that it is most desirable that something should be done for the protection of arts of design.

152. Do you consider that the suggestion you have made would be practicable without interfering with the general convenience of manufacturers throughout the kingdom?—There is a certain class of manufacturers whose convenience it would most materially interfere with, in the same way that the police interfere with the practices of certain men.

153. You say that you think you ought to have it for three years; by what means could the numerous manufacturers of similar articles throughout the kingdom know when the period had expired?—I would say, that upon each article registered there should be a royal cipher and a crown cast, and a penalty should be attached to the casting that without a register, and there should be a penalty attached to casting it after the period of protection had expired, so that the public would know what articles were under the protection.

154. Suppose you put a crown upon an article on the 27th of July, how could a man that makes similar articles in Scotland, upon seeing one of those grates, discover from it whether your protection commenced in 1835 or 1837?—There would be the central register here, which should be open to the public, and he might obtain a drawing of any particular design by applying to the Register-office, and if it was worth his while to make it, it would certainly be worth his while to apply for a drawing of it; but if it was necessary, the date might be put upon most things; upon a large article it might be done with the greatest facility, but there are many things so small, that we could hardly put the date upon it; for instance, an ornament that would have to be cast in the sand.

155. Do not you think, that if there was not the facility of copying that now exists, any new invention would be more slowly promulgated through the people?—We visit every town in England twice a year, and therefore the whole country has an opportunity of having those things if they please. The fact is, that instead of each house making designs for itself, or each employing an artist competing with the artist of another house, there are not above two or three now producing models for the whole of the kingdom.

156. Do you think it would be possible to effect the object in this way, by allowing the inventor to permit other persons to use the invention upon payment of a certain sum to himself?—I do not think that could be done; I think men would be more disposed to produce their own, than to live upon the reputation of their neighbours.

157. Is not there great difficulty in discovering what is a distinct pattern, and what is only a variation from a previous pattern?—There is the greatest difficulty there; but I think persons would not be willing to produce a pattern that was doubtful as to its originality.

158. Do

158. Do not a great number of ornaments consist of a combination of old materials, and is it not likely that any other individual might combine those materials in a manner so similar as to make it difficult to know whether he had the object of piracy in view, or whether the similarity was not casual?—There would be so much of the particular mind and style of the artist, as to fairly constitute an original.

159. Is not this particular grate now before the Committee a combination of common ornament?—There has never been any thing approaching this before.

160. Unless it were so distinct, would it be worth your while to pay so much to your designer for it?—Certainly not.

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WILLIAM EWART, ESQUIRE, IN THE CHAIR.

James Morrison, Esq. a Member of the Committee, was Examined as follows.

161. YOU are at the head of a large commercial house in the city, are you not?—I am.

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162. Of the well-known firm of Morrison & Company?—James Morrison & Company is the name of the firm.

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163. You are large purchasers of manufactured goods in this country, as well as on the continent, are you not?—We are large purchasers of manufactured goods in this country, and also purchasers to a considerable extent of goods on the continent for home trade, as well as for export trade.

164. You of course have been well acquainted for many years with the relative state of the manufactures of this country and other countries?—I have been well acquainted with the state of the manufactures of this country for more than 20 years.

165. Has your acquaintance with this subject induced you to make any observations on the inferiority or the superiority between British and Foreign manufactures, as far as the arts of design are concerned?—As a matter of business, I have been long acquainted with the general state of manufactures, and as a matter of curiosity I have paid attention to the arts of design as applied to manufactures in foreign countries.

166. Do you consider the English manufactures superior as far as regards the manufacture of the goods, but inferior in that portion of them which is connected with the arts?—I have found generally that we have been very much superior to foreign countries in respect of the general manufacture, but greatly inferior in the art of design.

167. What are the principal articles in which you consider our inferiority in art is perceptible?—It is very strikingly the case in all the arts of design connected with the silk manufacture, which is essentially a fancy trade.

168. To what circumstances do you attribute the superiority of foreign manufactures in art over our own?—To the fact that on the continent they have public schools for teaching the art of design; that it has been part of their system to educate men as professors of the art of design as applied to the manufactures, and also as teachers; whereas in this country we have neither the one nor the other.

169. Have you not had an opportunity of visiting establishments abroad for connecting design with manufactures?—Having travelled on the continent on different occasions, I have always visited the manufacturing establishments with a view to judge of their state as compared with that of England.

170. What institutions have we at home corresponding with those abroad, which you think will in any degree enable the manufacturing population to acquire a knowledge of art?—For the improvement of the arts in connexion with manufactures we have no establishment whatever. At the Royal Academy the attention of the students is directed chiefly to the human figure. We have I believe private teachers in London, but I hear that they also apply themselves more

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particularly to the human figure, and in fact they educate people for painters and sculptors, rather than as artists for manufactures.

171. There does not exist in this country that cheap mode of acquiring a knowledge of art, which abroad is demanded by the manufactures?—We have no kind of public school of art as applied to those objects. I believe I can state that with regard to several of our large towns, though there are persons that are called designers, yet they have not been educated as such, and in point of fact, they know little of the principles of art.

172. Do you think it would be of great importance to our manufactures to encourage a familiarity with design among the manufacturing population?—There is no doubt that it would be desirable that it should be encouraged, and I should say in this country more especially it seems an absolute necessity, because some branches of our manufacture really languish from the want of encouragement in the art of design. I should further say, that with respect to the art of design, there is no want of encouragement on the part of the public, and that we are now, and have been for a long time, obliged to resort to the continent for the purpose of purchasing their new designs, and in fact our manufactures have been greatly benefited by the opportunity of purchasing foreign art in that shape.

173. You mean to say that even the competition, with the opportunity of seeing their patterns, have been a benefit to our own manufactures?—The truth is, we have generally copied the French patterns, and if we have attempted to alter, we have only injured them, so that, in point of fact, they are all French; I am now speaking more especially of the silk trade.

174. Have you ever been struck with the great attention and activity the subject of patterns excites in France, and that it increases the value of the article?—I consider it is a matter on which the manufacturer there chiefly relies, and if he is fortunate in his patterns he makes a successful year; if otherwise, his profits are materially less.

175. Is it not generally the opinion of the French, that the man who is lucky in a pattern, is the fortunate manufacturer of the year?—Certainly. I have understood in certain houses that the manufacturers were doing well, because they had been fortunate in their patterns; their success for the season resulting from their superiority in that respect.

176. That shows the importance they attach to it, does it not?—Yes.

177. Is it perceptible in such articles as silks, ribands, shawls, gloves, and also fancy goods of every description, that they have this superiority?—It applies more particularly to the silk trade, but it applies also to woollens, and generally to all articles in which there is a figure.

178. Does it not also apply to metals?—The art of design more particularly applies to the metals, in which I think we are greatly deficient.

179. Does it not apply also to the arts as applied to architectural decorations, and the designs with respect to houses?—Particularly so; I understand from architects that there is a great want of that kind of talent in connexion with architecture; so that however good a design may be, the parties executing it not having been taught the principles of art, are not able to execute fine designs as they should be.

180-1. In the architectural changes that have been going on, have you been struck with the want of that superior taste which you think we ought to have?—Yes, the deficiency is certainly evident.

182. In fact, there is a connexion of course between the arts; the higher branches of the arts, and mere household furniture?—Architects have, I believe, attended to that subject of late years more than they formerly did, from the labours of Mr. Bullock some years ago, and I would add especially the publication of Mr. Hope's book. Much improvement has taken place; but no doubt great advantage would further arise from the establishment of a school of art, embracing form, proportion and ornament, and this advantage would not be confined to the manufacturer of furniture, but it would be extended to the country at large, because it would give employment to many, as well as be an improvement to the public taste.

183. Is not that perceptible, the connexion between the classical, the antique and

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and the common purposes of decorating the interior of houses in many instances in which the patterns from Pompeii have been adopted with great success in public as well as private mansions?—Without entering on questions connected with the higher orders of art, I should say all those matters influence our taste, but I have some doubt whether they would be suitable to our habits.

184. Have you observed in Paris, that much of the designs of Pompeii have found their way into the shops and private houses?—I cannot say that I particularly observed them there.

185. But in those buildings lately in London, do not you trace in the alterations of the Pantheon and in the decorations of the Lyceum Theatre, the very same designs that you trace in Pompeii?—No doubt of it.

186. Does not the Arabesque style, which was a style peculiar to Pompeii, prevail very much at Paris?—I have observed it in France, and also in Italy, and I am told that the Arabesque, about 35 years ago prevailed in this country.

187-8. Are you aware that in Italy the class of decorators form a very numerous class indeed, particularly in Southern Italy?—I should suppose from their works it must be so.

189. And are you aware that there are scarcely any houses, except the very lowest houses, of the inhabitants which are not in some way or other decorated by one or other of these decorators?—One sees the evidence of a feeling in favour of art every where in Italy, and one rarely observes it here.

190-1. Did you, upon the whole, observe, during your excursion on the continent, where there was existing a great mass of population, and where there were fine specimens of the arts, either in architecture or sculpture or painting, that a taste in favour of the arts appeared to be general and diffused, and to be operating upon the mass of the population?—There is no doubt that, admitting the public at large, especially the working classes, to see fine collections of works of art, has been eminently useful, and that it gives them a taste for the high character of art.

192-3. You think it very desirable to encourage the arts as connected with the architectural decorations of the interior and the exterior of our houses?—I alluded to that in connexion with the manufacturing arts; and I think it is very important that they should be encouraged.

194. Do you think that the French are more skilful than we are in the combination of colours and in chemistry as connected with manufactures?—I think they are. We have to lament that we have not a better educated class in chemistry as well as in the art of design. I believe the French are superior to us in both these.

195. Have you ever turned your attention to the best means of encouraging this knowledge of art among our manufacturers; would you think it advisable to establish central schools in London, or provincial schools?—I think a public school in London is, in the first place, absolutely necessary. After persons shall have been prepared to teach, there ought to be similar institutions in the large manufacturing towns.

196. Do you think that in London they would have greater facilities for acquiring information on all those branches of art connected with the manufactures; London being the emporium of art, as it were, there would be greater opportunities for artists of every description to learn that which was applicable to that branch of the manufactures which they intended to pursue?—No doubt of it.

197. Are you aware that at Berlin they have schools of that kind; that the principal school of art as connected with manufactures is in Berlin, and that there are provincial institutions existing also separately from those in Berlin?—I have understood such to be the case, but I have never been at Berlin.

198. Have you not been so much impressed with the propriety of encouraging such institutions, that you yourself have taken an active part in trying to encourage the establishment of them?—I have felt so much the want of such institutions, especially since the discussions on the subject of free trade and the admission of foreign manufactures, knowing our inferiority was altogether in the art of design, that seeing the thing was not done, I have myself offered to assist in the establishment in London of a school of art connected with manufacture.

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199. In fact you were so convinced of the beneficial effect it would have, that you offered to make a very considerable advance yourself to assist that object, did you not?—I did.

200. And several other gentlemen, and many eminent persons, and among others Lord Brougham, took an interest in the question, did they not?—Lord Brougham has always taken great interest in it, and something I imagine would have been done, but for the expectation that Parliament would have adopted some measure.

201. You have, of course, turned your attention to the means of encouraging manufactures, by opening to the eyes of the people, galleries, collections of casts, in fact, giving them every opportunity of instructing their minds in art, and creating a desire for art, by the observation of that which is beautiful?—Undoubtedly, it is most desirable that they should be encouraged to visit such institutions; and I very much regret that the British Museum and the National Gallery are closed on those days upon which it is the most convenient for the labouring classes sometimes to attend.

202. Do you think that sufficient attention has been paid to what may be called the education of the eyes of the people by our own Government, or has it been as much attended to as that species of education has been attended to abroad; that is, by freely opening galleries to encourage and increase the taste of the people?—I think it is a very extraordinary circumstance that, whilst in small states, where there are scarcely any manufactures, one hears of schools of design, yet in this country, at the head of the manufactures of the world, and where it would be of the most importance, we have nothing of the kind.

203. Have you ever considered how far the Government should interpose in the encouragement both of institutions like open galleries and instruction connected with the education of artists?—It is rather difficult to say how far the Government should interfere. If the public could be induced to interfere, they would do it generally better without the Government than with it. But I think Government in this case, as in the case of the National and British and Foreign Schools, might grant a certain sum of money in aid of local subscriptions.

204. You think they might superintend and interpose without unduly interfering?—I think they might assist in the establishment of such an institution, and, when established, it might afterwards support itself.

205. You think it is of sufficient importance to be made a national object, do you?—I think it is at its commencement. I think also, that the extension and improvement of our national works of art, would be a very wise use of the public money.

206. Are you aware that in France the Government assists the municipalities in the formation of such institutions?—I have so understood.

207. Are the Committee to infer from what you have said, that there is no want of talent in the country, but that there is a want of encouragement for the application of art to the purposes of the manufactures?—There is clearly no want of talent, because in those branches of art which are encouraged, I think we are decidedly superior to other nations.

208. Have you had an opportunity of considering the want of protection for inventions of patterns and designs, both in tissue goods and also in metal works, in this country?—I think the want of protection is, in all cases, an immense check to the progress of the arts of design.

209. The question has reference to the want of protection in the patent right?—There can be no want of encouragement on the part of the public, because all the manufacturers allow that if they produce very superior articles, however expensive they may be, there are parties ready to purchase them. The reason why they do not produce more and better, and why they do not encourage artists to follow that as a profession, is that their patterns, if good, are immediately pirated.

210. Do you think it desirable that the law should give a better protection to the original inventor of these designs than it does at present?—I think a protection for a limited period, sufficiently long to encourage the manufacturer to make the outlay of his money in the first instance, avoiding, as far as it is possible, the confusion which would arise from a great number of persons claiming the
right

right in similar patterns, as they must resemble each other. I think that is the sort of protection that should be given. It should in many cases, I think, be limited to a season, say six months; in other cases perhaps a period of one, or two, or three years might be necessary.

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211. Do you not think that there has been a great improvement in the productions of this country, though you think that there has been no improvement in art as applied to manufactures?—There has been a very decided improvement, so much so, that the best articles manufactured before we had imported the manufactures of the continent, would, in some branches, be now quite unsaleable.

212. Do you think that that improvement is merely an improvement of foreign articles, or is it creative to a certain extent?—It is generally imitative.

213. You think there is a growing demand for manufactures in which the arts of design are best exhibited?—Undoubtedly.

214. Do you think that the taste of the country is so improved, that articles which were current and fashionable articles some years ago could not now be sold?—Yes, but that fact may arise from various causes.

215. Does not the fashionable taste in itself require a better system of art; that is, is the fashionable taste improved?—Undoubtedly.

216. Have you not had occasion yourself frequently to suggest improvements to British manufacturers?—I have had occasion not perhaps to suggest any particular improvement, but I have urged upon them from time to time the necessity of making improvements generally, and of improving the quality and style of their goods.

217. Do you find any particular disposition on the part of our manufacturers to spend money for the purpose of the application of art to their manufactures?—I hear on all sides their objection that they are not protected, and that if they were to expend money on patterns, they would only be doing it for the benefit of others.

218. Are you aware that in some of the manufactures of France in which art is most expensively applied, that the absolute outlay of capital is ten per cent. upon the production?—I am not aware of the exact proportion, but I know it is very considerable.

219. Is there not a class of individuals in France who are a sort of consulting manufacturing professors, persons to whom the manufacturers are in the habit of applying with reference to the formation of colours?—I believe there is.

220. Do not you think that such a class of persons would be very desirable in England?—Most desirable.

221. Is not Clement Desormes one of those persons?—Yes.

222. If there were a class of intelligent chemical professors, such as Clement Desormes and others, who were habitually consulted by manufacturers as to the means of improving colours, and the application and advantage of chemical arts to manufactures, do not you think that would be exceedingly useful?—Yes; at present the manufacturer does not employ artists to design, for the reasons I have given, and probably for the same reason he does not lay out his money in chemical skill.

223. Do not you think that the ignorance among manufacturers as to art generally has been a great impediment to the introduction of chemical knowledge in the manufacturing field?—There is no doubt of that. But I should say that that is owing to the deficiency of scientific education among the middle classes, in which France, it is generally understood, is so superior to us. I should also state, that the new colours, as well as the new patterns, originate in France. We have a vast number of colours now in our manufactures which were quite unknown a few years ago, and there is scarcely one of them which has not been originally imported from France; that, however, is partly owing to the fact that the fashions are set there.

224. Did you ever hear an expression of surprise from the French manufacturers as to the great superiority of our manufactures, as far as regards the mechanical skill, and our great inferiority in the chemical arts and the arts of design?—I have frequently heard such an expression.

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225. The system in France in most cases is this, is it not, that the central government shall allocate out of the general fund a certain sum for the schools of art, and the municipalities should furnish the deficiency?—Yes.

226. Do you think that would be convenient in this country?—I think it would, at least in the commencement; but I doubt whether it would be necessary to permanently continue any annual allowance to them.

227. As far as your observation goes, do you not believe that the principal manufacturing towns have a strong feeling on this subject, and would be willing to co-operate in it?—I believe they have a very strong feeling, although it has not been expressed to Parliament very strongly before; but this is mainly owing, I suspect, to the hope they have clung to of getting foreign manufactures in some branches again prohibited.

228. Are you aware whether they have represented in any petition to Parliament, with respect to our manufactures, that they are inferior in pattern and design to the French manufactures?—I have seen it stated in a petition from Foleshill, near Coventry, where the ribbon trade is extensively carried on, that they are deficient in that respect only, and praying for some encouragement or assistance.

229. Are you aware that funds have been lately raised in the town of Nottingham for the special purpose of establishing a school of art?—I have not heard of that.

230. Are you aware that the Mechanics' Institutions in different towns have devoted a certain portion of their funds for the encouragement of art and the encouragement of design?—I am aware of it, but I have doubts whether in the present state of things in this country they would find persons competent to teach them.

231. Is there not at present on the part of the manufacturers a much greater disposition to acknowledge their inferiority than existed some years ago?—I think there is, and indeed it would be impossible for them to deny it, because they all copy from the French.

232. As the honourable Member has stated that he thinks it important that the invention of patterns should be protected, could he suggest to the Committee any machinery by which that object could be accomplished?—The only mode which has occurred to me is that of copyright, depositing a model or pattern of the article to be protected in some public office.

233. You do not think that the exceedingly cumbrous machinery of the patent office could be applied to the protection of patterns where the value of the copyright is so transitory?—I am not acquainted, in detail, with the mode of transacting business at the Patent Office.

234. One of the most important results to obtain is rapidity in the recognition of the right, and economy in obtaining the monopoly of it; is not that so?—Yes, and for that purpose it appears to me that we want some sort of tribunal which should adjudicate upon questions of that sort.

235. Do you not think that local tribunals, composed of masters and men, might be conveniently and usefully introduced for the protection of patterns?—For all matters connected with disputes about wages, and the good or bad workmanship of the operatives, I think a union of the masters and men would be very desirable; but I do not see in questions relating to rights of pattern, which are questions between master and master, that the introduction of the labourer is necessary, or that it would be convenient.

236. But if the labourers were intelligent labourers, and instructed as you propose to instruct them by schools of art, would they not be important persons to whom questions as to the valuation of copy-rights might be referred?—I think they would be very good witnesses as to what was or what was not an infringement of a patent; but I am afraid that some years must elapse before we could see them sufficiently well educated, either in art or general education, to act as judges on the subject.

237. Did you ever hear it stated by French manufacturers that they have received important suggestions for the improvement of patterns from the hand-loom weavers?—I have, and I recollect a circumstance which was mentioned to me some years ago at Paisley, which showed in a very striking manner the advantages

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tages derived from the superior education of the working classes in Scotland; a manufacturer there showed me a piece of goods copied from a French pattern that he had put to work; the weaver, after making one or two pieces, applied to him and suggested an improvement, by which the wages were reduced 25 per cent. upon the manufacture of the article; and I would observe that that article was one with which we came into competition with the French manufacture in our market.

238. Do you not think that the inferiority of our English artists is in some degree owing to the want of demand by the public for those improvements in manufactures?—Certainly not; on the contrary, the public very willingly give very high prices for foreign articles, and they would, I have no doubt, purchase English manufactures at the same prices, if we possessed similar excellence in art.

239. Do you think that their taste is concerned in the preference, or do they not very often select from foreign articles those articles which are inferior in point of art, though they may be for the moment attractive in point of fashion?—I very much doubt whether that preference is given for foreign articles, merely because they are foreign; I think the public are always ready to purchase our own goods when they are really equal to foreign.

240. Do you not think that if foreign articles evince a superior degree of taste, they are immediately preferred in this country as well as abroad?—Undoubtedly.

241. You think that in proportion as you extend the taste of the community, that of course there would be a greater demand for those articles in which taste is evinced?—Certainly.

242. The great mass of the community in this country, not merely the lower and the middling classes, but a great portion of the upper classes, have not had their taste proportionately cultivated, in proportion to their education; is not that the fact?—I believe that that is the case.

243. Do you think that that arises from the want of opportunities for the cultivation of that taste, such as the deficiency of public institutions, libraries and museums, and public galleries, or do you think it arises from the neglect which is shown to that department of education during the course of their studies at college and at school?—Much is owing to the want of what may be called elementary education at schools and colleges, but it is chiefly because fine examples of art are not constantly before their eyes; a kind of education that is perfected in rather an adult age.

244. Did you not find on the continent, particularly in Italy, even among those classes that have had very little previous education, and also in schools or colleges, there prevails a general feeling for the arts, and that they with pleasure frequent galleries and public institutions which are open to them by the munificence either of government or individuals?—I have been merely a traveller in Italy, not a resident there, but one cannot even pass through a town without being struck with the regard and respect they entertain for art, and the great love they have for it.

245. If public galleries and public institutions and public museums were open more generally to all classes of people in this country, you think that a very strong feeling for art would be gradually generated, do you not?—I think it is already generated to a great extent in this country among the upper classes, and we owe much to those gentlemen who have supplied the exhibition at the British Institution from year to year; the National Gallery has been very beneficial, and the improvement of our street architecture has also been very useful.

246. Do you see that improvement in taste evinced not only in the capital, but in other parts of the empire?—Undoubtedly. In the course of some recent visits which I have paid to different parts of the country, I have been very much struck with the improvement in our provincial towns.

247. Would you have the goodness to state some of the instances that have come under your observation, in which that improvement has been the most remarkable?—Birmingham and Liverpool particularly.

248. Do you think that in order to disseminate generally a feeling for the arts among the middle and lower classes, one of the first essentials would be cultivating to a more considerable degree that taste in the higher classes during their college education?—

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education?—It may be doubted whether Oxford or Cambridge ever can become a good place for the study of the fine arts.

249. In order to diffuse this love of art among the middling classes, would you not recommend that the cultivation of drawing, for instance, should form, to a certain degree, a portion of their education?—Undoubtedly; the use of the pencil cannot be introduced too early.

250. Would you extend that to elementary education; to elementary schools, that every child should learn a certain portion of drawing?—I think that might be useful, and it would be the more readily ingrafted hereafter in the systems of our popular schools, but I doubt if we are prepared for it at present.

251. You are aware that it has been introduced in Germany and in Switzerland, are you not?—I have understood so.

252. Do you suppose that there is any thing so distinct in our organization from that of other countries, that would preclude its introduction from our elementary schools?—I should say, on the contrary, it is better suited to a dense population and a great manufacturing people.

253. Would it entail any additional expense in education, the introducing of such a system?—I should answer not, if our teachers had themselves been educated for the purpose.

254. Is it not your opinion, that it would be an excellent thing both for the artist and the consumer of works of art, to make art to a certain extent a part of elementary national education?—I should say it would be very desirable, and especially in our manufacturing towns, but until we have schools where teachers may be formed, it would be impossible, I think, to commence a thing of that kind with effect.

255. Is it not the fact, that some time ago French papers were introduced to a great extent?—Certainly.

256. And has not that introduction diminished since our artists copied their patterns; that is, with respect to paper hanging?—That I have no doubt is the case. It is certainly the case in most of our printed articles, that as our taste improves, so does that of our manufacturers, and there is less demand for foreign productions.

257. Are you aware that the importation has diminished since the patterns previously introduced have come to be copied in England?—I have no doubt that such must have been the case, although I have not particularly inquired about it. But I should say generally as to manufactures with which I am better acquainted, that our manufactures have gradually supplanted one foreign article after another, till now the importations are confined merely to the novelties of the season, and these, as soon as our manufacturers copy them, cease to yield a profit upon the importation.

258. Are there not a great number of branches of art connected with modelling, where a degree of education is required?—Undoubtedly.

259. And therefore it is impossible that in those branches of art, without giving the education, we should have the benefit of the designs of other countries?—Certainly.

260. Does it not require a degree of previous education to appreciate the beauties of the higher branches of art?—Unquestionably.

261. Therefore is it not your opinion that an uneducated man sent into a gallery of works of the higher orders of art would be capable of appreciating them?—Undoubtedly,—in the higher branches of art.

262. Therefore the establishment of museums and galleries would not be sufficient to effect that purpose, but it would only be an accessory; is not that the case?—It certainly, alone, would not produce that effect; but as there must be much talent for art existing, such exhibitions produce, perhaps insensibly, very considerable effects; they operate, directly or indirectly on the public mind, and I have no doubt diffuse benefits through all the different grades of society.

263. Can you inform the Committee whether in that species of education which has been alluded to, modelling would not be a very important part, as well as drawing?—

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drawing?—It is absolutely necessary; and I understand partly to supply that want, that in the institute of British architects they propose to establish an institution of that kind.

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264. Are you aware of the fact, that the *formatore* in this country are, without any exception, foreigners?—I have understood that foreigners are generally employed in casting figures; whether there are any English or not, I do not know; but I believe that we are very much indebted to Italians for the diffusion of a taste for art among the middle and lower classes.

265. Do not you think that the style which now prevails, and has lately prevailed a good deal in this country, which is called the Louis Quatorze style, that a good deal of its success is attributable to the want of skill in our designers?—I do; and whilst I think it is an evidence of the disposition on the part of those who have the means to expend their money on such articles, I think it probable that they would have spent the same money upon what may be considered a better style, if they had had the opportunity afforded them.

266. Do not you see a general preference given by the upper orders to that style of art, even when they may select from either Gothic or Greek specimens, that they still prefer the style of Louis Quatorze?—I think that that is a fashion which is passing away.

267. You stated that you observed a considerable improvement in the taste displayed in our public buildings in the streets?—I did.

268. Do you think that that taste has been well directed?—I should offer an opinion upon that subject with a great deal of hesitation; I should say it has not; but undoubtedly it has produced an effect very superior to what existed before.

269. Do you consider that it is quite unnecessary that those people high in authority who have the superintendence of those buildings, should know any thing of the art which they are called upon to direct; do you not think that it would be an advantage rather that those people high in authority who have the direction of those monuments, should know something of the art that they are called upon to preside over?—I think it very important that we should have responsible public officers to take charge of our public buildings; that supposes, of course, persons duly qualified.

Veneris, 31^o die Julii, 1835.

WILLIAM EWART, ESQUIRE, IN THE CHAIR.

Mr. Samuel Smith, called in; and Examined.

270. YOU are of the well-known firm of Harding, Smith, & Co. of Pall Mall, are you not?—Yes.

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271. Have you not had very extensive means of acquaintance both with English and Foreign manufactures?—We have been a good deal confined to the fancy trade.

272. Has your experience led you to observe that there is any marked distinction, in that part of manufacture which relates to design and art, between the foreign and English manufactures?—In the finer description of fancy goods, the French taste prevails certainly to a very great degree.

273. To what do you attribute that prevalence of French taste?—I attribute it principally to the want of artists and schools of design. In this country the manufacturers have no means of obtaining designs excepting by copies from the French for the most part.

274. Do our artists copy much from the French?—The manufacturers I think copy very much from the French.

275. Is the extension of a knowledge of art among the manufacturers made more a national object in France than it is England?—I should think it is, inasmuch as I have visited artists myself in Paris, where I have found as many as six or eight clerks under one employer.

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Mr. Samuel Smith.

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276. Can you inform the Committee whether or not French manufacturers do not, at occasional intervals, attend in London with patterns for your trade?—It is usual at the present season, and also about January. We are waited upon by the manufacturers of Lyons, or their agents, which is the same thing.

277. They bring you patterns for the season, do they not?—For the approaching season. It is usual for them to bring us patterns, some drawn upon paper, but the majority a portion of goods absolutely made; these will extend probably to 200 designs, in different fabrics.

278. Do you mean 200 designs in the article itself?—Comprising silk ribands and various descriptions of fancy goods; I am speaking in round numbers.

279. Is the cartoon full of designs?—The cartoon is merely the book that contains them. They bring a book of patterns, which will contain at least 200 designs.

280. What proportion of those designs is of the article itself?—I have already stated that the greater portion are absolutely manufactured; but only a small quantity is brought here, with the intention of being exhibited as patterns. What proportion is afterwards made will entirely depend upon the orders the agents may succeed in obtaining.

281. How many English patterns are submitted to you by the English manufacturers in the same period?—The English manufacturers experience much difficulty in this respect. They more commonly ask us for designs or patterns, or if we know what the French are likely to produce. We have very few, and sometimes none, submitted to us by the manufacturers.

282. Then the difference is, that in general the French manufacturers submit designs to you, and on the other hand you submit designs to the English manufacturers?—Yes; there is another disadvantage the English manufacturer has, if he shows you any thing, it will perhaps be merely an indifferent paper drawing; whereas the other produces the thing itself, and we see the thing absolutely made, which is a great advantage to a person who is not a manufacturer, because he cannot judge from the drawing.

283. Then in the French designs, the greater proportion are patterns of the articles themselves?—Yes.

284. Of the English designs, the greater part are mere paper drawings, by which of course the dealer cannot judge so well of the effect of the pattern as when the article is itself produced?—Exactly.

285. What is the proportion of plain French silks which are sold by you?—Speaking of “plain” goods, I should think our sales are probably quite two-thirds English, and one-third French.

286. What is the proportion between the English and French figured and fancy silks which you suppose you sell?—Figured and fancy silks, I should say that better than one-half were French, and the quantity of French sold consists of the articles of the best quality and the richest designs; the more common-place ones are of English fabric; the articles of higher taste and more expensive are French.

287. What proportion of the finer fancy goods are French, and what English?—They are almost exclusively French; but as the lower descriptions are in more daily consumption, it brings up the quantity of English to be nearly proportionate to that of the French; but the higher description is decidedly French.

288. You are speaking now of silk goods, are you not?—I am confining myself entirely to fancy silk goods.

289. What proportion of fancy ribands which you dispose of are English, and what French, do you suppose?—There the superiority is very great in favour of the French; I should say, three-fourths of what we sell are French.

290. Now with respect to shawls, what proportion of the shawls do you suppose are English, and what French?—There have been considerable changes in the manufacture of shawls within the last few years; at the present moment, the great consumption of shawls here is French, to the exclusion of what we formerly called the Edinburgh and Paisley shawls.

291. What has been the effect of the foreign shawl trade on the English shawl trade, within your recollection?—I am speaking now of a very recent period; it is within four or five years; the Lyons and Nismes shawls have caused that.

292. Are these shawls of the same fabric?—Yes, the same fabric as what is generally known as a Scotch shawl. The Scotch shawl trade has been very much injured by the introduction of the French shawls within the last few years, which I think is greatly owing to the superiority of the pattern and design.

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293. Is the material the same?—Yes, it is generally the same; our shawls were generally made with a border sewn on, which was repeated year after year in a Scotch manufacture; the French, on the contrary, have launched out into a variety of designs, extending all over the shawl.

294. The finer shawl trade is nearly annihilated by the introduction of French shawls of superior design?—Yes.

295. Are you aware of the peculiar pains the French take in their designs of shawls?—I have not, except from having read extracts from a work which I shall be glad to refer to.

296. Will you refer to the remarks, and give us the substance?—I would refer, as an instance of the extreme pains the French take, to the following extract from a work, entitled “*L’Industrie; Recueil de Traités Elémentaires sur l’Industrie Française et Etrangère*.”—“*Le dessin nouveau, proposé pour les châles par M. Couder, est, chez lui, le produit de longues études qu’il a resumés dans une brochure fort intéressante, et qui n’est pas moins digne d’attention que les dessins eux-mêmes. M. Couder, soumettant à une analyse attentive et ingénieuse ses dessins si bizarres et si confus du Cachemire indien, a pensé que leurs formes, continuellement anguleuses et brisées, étoient bien plutôt un resultat de fabrication qu’un produit d’art. L’étoffe du Cachemire étant croisée, il s’ensuit que dans une fabrication imparfaite, comme l’est celles des plus beaux Cachemires indiens, l’ouvrier transforme continuellement des dessins arrondis et gracieux, en lignes droites et contournées, qui altèrent la pensée du dessinateur, au point de nous l’apporter complètement méconnaissable. Une fois sur la trace de cette idée, M. Couder a fait des recherches plus précises, et par des rapprochemens simples autant qu’ingénieux, il a donné à sa découverte toute la rigueur de la démonstration. Nous reproduisons (Pl. 16. 2. 3. 4. 5.) quelques-unes de ses comparaisons entre les dessins actuels des châles de Cachemire et les dessins originaux des artistes persans. La seule inspection de ces dessins suffit pour montrer toute la justice de l’assertion de M. Couder; savoir, que les dessins actuels des châles de Cachemire, ne sont rien autre chose, que des dessins altérés par des ouvriers ignorans et sans goût, étrangers autant qu’insensibles à la beauté des formes.*”

297. Now supposing the French manufacturer wanted to have a pattern, what facility would he have in procuring it?—I have not been in Lyons myself, but I understand there are persons there whose profession is design, and also in Paris.

298. Do you recollect some very beautiful shawls that used to be made in the vicinity of Stockport some few years ago?—They were the first shawls that we used to term “imitations of India,” which were made by a person of the name of “Cowderoy;” they were made entirely of spun silk; but the fabric is no longer in use, and has not been for the last ten or fifteen years.

299. They have now ceased to be made, have they?—Yes, for many years; they were made entirely of spun silk.

Mr. Benjamin Spalding was then called in, and Examined in the presence of Mr. Smith, as follows:

300. To Mr. Spalding.]—WHAT business are you?—I am the buyer of Messrs. Harding & Smith in Paris. Mr. B. Spalding.

301. To Mr. Spalding.]—Suppose a French manufacturer wanted to have a pattern in France, what facility would he have of procuring it?—There are people who are in the habit of drawing patterns for manufacturers, who are likewise acquainted with the working of the pattern, which is a facility they have not in this country.

302. To Mr. Spalding.]—You consider it is one of the advantages of the French system, that the drawing is made by a practical man, do you?—Yes; he is likewise a practical manufacturer.

303. To Mr. Spalding.]—In France, the manufacturer has also this advantage, that his practical manufacturer, who makes the drawing, is also a well-educated artist?—Yes.

304. To Mr. Spalding.]—Suppose an English manufacturer wanted to have this advantage, what facilities would he have?—There is a great difficulty in getting a pattern for a work in England.

305. To Mr. Smith.]—There are, however, pattern-drawers of course in England?—There are quantities.

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306. To Mr. *Spalding*.]—What are the difficulties of the pattern-drawers?—I think the great difficulty is, that they have not been sufficiently acquainted with putting the work into the loom; but that would only apply to silks or shawls.

307. To Mr. *Spalding*.]—Do you consider that the English pattern-maker is defective in a knowledge of the mode of putting his pattern in the machine?—Decidedly so.

308. To Mr. *Spalding*.]—Is he also inferior in a proper knowledge of the art of Design?—I should say he was decidedly.

309. To Mr. *Spalding*.]—Have you ever observed that there is a great superiority on the part of the French manufacturer in the combination of his colours?—Decidedly.

310. To Mr. *Spalding*.]—That is, the combination of the colours is so adjusted, that they please the eye more in the French manufacture than in the English?—They are better blended in the French manufacture than in the English.

311. To Mr. *Smith*.]—Do you consider that the French dies are superior to the English?—I should say, for the most part, the French are more brilliant, but many of ours are more permanent.

312. To Mr. *Smith*.]—Will you have the goodness to mention in what particular colours you think the French are superior, and in what you consider we are superior to the French?—I should say we are superior to the French in blacks, greens and violets.

313. To Mr. *Smith*.]—Then you think in those colours the English are superior, do you?—Yes.

314. To Mr. *Smith*.]—And in what do you think the French are superior?—I do not know that I can recollect any particular colours in the French, but there is a general brilliancy in their colours; there are some few colours that we cannot equal here, and they produce new shawls of colours that would not have been thought of in England.

315. To Mr. *Smith*.]—Are you aware that any inconvenience has been felt in England, for the want of protection to the inventor of a new design?—I rather think there has; we frequently are at an expense in getting up a fancy article, and it too frequently happens that it is copied in a different quality, which of course is an injury to the manufacturer.

316. To Mr. *Smith*.]—Is there any branch lately originated in France composed of a combination of woollen and silk manufacture?—Yes, a variety of materials composed either entirely of woollen or of woollen and silk.

317. To Mr. *Smith*.]—Is our manufacture indebted for its present eminence to the superior design of the French makers?—There has been altogether in many cases a new fabric by the French, some of which are figured in the loom, but many are printed.

318. To Mr. *Smith*.]—Do we import these fancy articles from any other nation besides France, or do they come from any other nation?—We import them exclusively from France.

319. To Mr. *Smith*.]—We do not import any from Germany, do we?—Only a few plain goods.

320. To Mr. *Smith*.]—Nor from any other country?—Nor from any other country but France.

321. To Mr. *Smith*.]—Do we export fancy goods to Germany?—I apprehend our Bandannas go there, but I am not acquainted with that branch of the trade.

322. To both the Witnesses.]—Are there any other facts within your knowledge relating to this subject on which you would wish to offer any observation, or do you think we have gone through that which is material; do you think it desirable, from any practical observation you have been able to make, to establish some schools of design, or that some other similar means should be given to instruct the British manufacturing artists?—[By Mr. *Smith*.] I do, because there are many articles which we are importing from France, which undoubtedly if we were in possession of designs, might be equally well manufactured here.

323. To Mr. *Smith*.]—Would you in that case be able to sell them as cheap as if they were imported from France?—Quite as cheap.

324. To Mr. *Smith*.]—You think the best way to counteract the French superiority, would be by the instructing our manufacturing artists, do you?—I do; I would.

would mention as a fact, and it has often been held as an argument, and rather pertinaciously adhered to by manufacturers, that a French article would sell without reference to its peculiar merit, but merely because it is French; that is not my opinion; in placing fancy articles before persons, which I do promiscuously, that is chosen which is most liked, without the question being put whether it is French or English.

325. To Mr. *Smith*.]—You think the public judge fairly between the two specimens, do you?—Yes, whatever the question might have been a few years ago, it is gone by now, and there is no prejudice of the kind.

326. To Mr. *Smith*.]—Could we compete with the French in lace?—Laces are made all over the continent, and we get the respective descriptions from the different countries, and therefore I do not think it applies.

327. To Mr. *Smith*.]—Can you mention any particular branch of manufacture which is depressed in consequence of the want of cultivation of design?—Broad silks, I would say certainly ribands, and more particularly the shawl trade.

328. To Mr. *Spalding*.]—How is it with respect to gloves?—The gloves are better cut in France; the great proportion of what we term fine gloves that we sell are principally French.

329. To Mr. *Spalding*.]—Do not the French take the measure of the hand better than the English?—There are very few manufactures in which the French excel so much as in gloves.

330. To Mr. *Spalding*.]—Do you trace that to any thing like a knowledge of art in the manufacture of the gloves?—It must be from a knowledge of the shape of the hand.

Lunæ, 3^o die Augusti, 1835.

WILLIAM EWART, ESQUIRE, IN THE CHAIR.

Thomas James, Esq., called in; and Examined.

331. I BELIEVE you are a partner in a wholesale house in the city, which purchases largely of the silk manufactures of Spital-fields and Manchester?—Yes.

332. Also of cotton manufactures?—Cotton manufactures also.

333. Are you of opinion that amongst that class of customers that you principally supply, there has been any increased power of appreciation of the beauty of design or of colour in the fabrics of English manufacture?—The fabrics that I am best acquainted with in our house are silk manufactures; with respect to colour, ever since the introduction of French goods, I think we have had a very considerable improvement in the colours, and in the patterns of the English silk manufacture, particularly in the colours.

334. Have the goodness to state in what particular department of the art of colouring silk has it struck you that the improvement has taken place?—I think that not only in the plainer colours, which may be called prismatic colours, but in those colours which are creations of fancy, the shades have been much more brilliant than we used to have them.

335. Do you think that the power of producing finer colours on the part of our manufacturers has increased, as also that there has been an increased degree of good taste in appreciating the colours?—Decidedly so.

336. I think you said that this improvement has been perceptible since the more free intercourse with France?—Decidedly so; I would say to the Committee, particularly referring to Manchester and Macclesfield, that at the time the country manufacturers came to London to attend the periodical sales of silk at the East India House, it was their custom to come to our house and other houses of our class, and obtain from us patterns of the shades of different French goods that we had bought or imported, and the imitation of these goods and patterns has led to these improvements, or at least has been co-existent with it.

337. Are you of opinion that from the excellence and beauty of our fabric, that if silk was still to advance and become dearer, that the public, so far as you have observed, would always repay that by an increased consumption?—Decidedly so;

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Mr. B. *Spalding*.

31 July 1835.

Thomas James, Esq.

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I think the difficulty of selling a bad shade of colour, whenever it does occur, is increased considerably on account of the general appreciation of good colours.

338. Has it happened recently that figured silks, silks in which there is more of art and of design employed, has it happened that a preference has arisen in favour of such over plainer silks?—Until the last two or three years the production and consumption of figured British silks was a mere trifle, but within the last year the production and consumption of British figured silks has been very considerable.

339. Are they much better than they used to be; are the figures more perfect and beautiful recently?—The figures are smaller, and I think are more beautiful in form than formerly.

340. It appears to be your opinion, that combining the beauty of design with a certain degree of neatness as well in tint as in colour, that the silk manufactured in England has materially improved?—I do think so. Perhaps the Committee will allow me to state a fact within my own knowledge as to the English manufacturers; formerly they were most apprehensive of the figured silks from France, and the contest in them was thought hopeless, but there is now executing in Spital-fields a considerable order for figured silks for America, where of course they must meet the French under no circumstances of protecting duty.

341. I think the Committee understood you that in the case to which you allude, it is not a speculation on the part of the manufacturer, but proceeds from a positive order on the other side of the Atlantic?—Yes, the result of previous samples.

342. If then the beauty of English manufactured silk goods is so materially improved, from our manufacturers having the opportunity of seeing the French patterns, you would infer, I presume, that there is a still greater capability of improvement if more means of improvement were placed within their reach?—Certainly.

343. Does any thing occur to you as important as affording the means of additional improvement by any particular mode?—I would request permission to be allowed to state to the Committee, that I think a matter of the first importance would be to give to the parties who originate patterns a property in the patterns for such a length of time as would repay the outlay and encourage the production of patterns. The Committee is aware that such a protection is given to the printer. When a pattern is framed on printed cotton, the party is protected by the law in the exclusive right of the pattern for three months, and I would suggest that protection should also be given to patterns framed in the loom.

344. Is it your opinion that that protection could be easily afforded?—We have the example of the French to show that it is easily afforded.

345. Have you at all turned your mind to the process by which that could be best accomplished?—I think that a question of detail, which would require some further consideration; I would rather just state the principle.

346. Can you, from recollection, at all state the French mode?—I believe I gathered it myself from Dr. Bowring's evidence. I am not quite satisfied that the French mode would be the best mode for us; something of the kind might do. There was one fact I wished to mention as showing the influence of taste in extending the sale of manufactures. It will be in the recollection of the Committee that some years ago an India handkerchief was almost the distinguishing mark of a gentleman; every gentleman had one in his pocket. India printed handkerchiefs of very common patterns were sold at from 7s. to 10s. apiece: now the great consumption of India handkerchiefs is by the importation of the unprinted cloth, and they are printed in this country with English patterns, but the cloths printed in India are now principally sold by hawkers to the lower class of consumers.

347. Recurring to what you have said formerly on the subject of colours, has not the importation of French coloured silks very much diminished?—The importation of French plain coloured silks has very much diminished; in fact it has almost ceased.

348. At first many were imported after the prohibition was taken off?—Many; and I beg to mention a curious fact as to the first importation. The first general conception among the British manufacturers was, that they would be beaten by the cheapness of labour in France: but on the importation of plain silks we did not import more than one piece of black to 50 colours; whereas the general consumption of the country is at the lowest one black to two colours. I mention this, because

because it shows how clearly it was a question of taste: had it been a question of labour, it might have applied to colours as well as to blacks. *Thomas James, Esq.*

349. Will you state what is the case?—There is little importation of either black or colours now. *3 August 1835.*

350. In consequence of the improvement in English coloured silks?—Exactly so.

351. To what do you particularly attribute the improvement in English colours?—To copying the colours from the French.

352. I want to know whether the same observation applies to velvets as to silks, in regard to colours and design?—Yes, I should think so, decidedly. There is very little, if any, importation of French velvet.

353. The French themselves import velvet from Southern Germany?—I think that is on account of its superior cheapness.

354. Notwithstanding our advances in the designs you have mentioned, are there still other advances desirable so as to enable us to compete with foreigners?—In our figured patterns we borrow very largely from the French. It is very desirable that we should create an original taste here; we are still behind the French in ribands and shawls; we borrow our figured patterns from France in a principal degree.

355. You think it desirable that we should take effectual means for connecting the arts with the manufactures of the country?—Decidedly so.

356. In your opinion is this almost the only thing needed to give the free power of competition, and almost of successful competition, to our manufacturers?—Decidedly so; perhaps the Committee will allow me to mention that, from the decided advantage that we have from China silk and our application of China silk, I do not fear that we shall decidedly beat the French in figured as in plain goods.

357. Are you aware, as an historical fact, that the French Government sent a mission some few years ago into the region of Cachmere both to introduce Cachmere goods, and also to speculate on the production of the Cachmere shawls?—I know it only from report.

Mr. Thomas Field Gibson, called in; and Examined.

358. YOU are engaged largely as a silk manufacturer in Spital-fields?—I am.

359. Are you engaged in making velvets?—In making velvets and plain and figured silks.

360. You have heard the opinion expressed by Mr. James, the last witness, as to the improvements made in design and colour in the English silk manufacture since our free intercourse with the French; do you concur in that opinion?—I do entirely. I consider that, previous to the introduction of the French manufactures, our taste in figured silks was very bad; that our trade existed under a very close monopoly, and that there was little application either of taste or capital to the manufacture; and since the year 1826, the period when French silks were introduced, we have improved very materially from seeing the production of French looms.

361. Do you know whether the French invention of 1832 has given any additional stimulus to improvement in our silk fabrics?—I am not prepared to say that it had any immediate effect upon the manufactures; but I think it gave us a much more clear insight into the nature of French manufactures, and so far we have benefited by it.

362. Do you happen to have any patterns with you of the sort you are now making?—Yes.—[*Producing them.*]

363. What patterns are you now making principally?—The description of figured silks which we are now making in Spital-fields are of a very small and insignificant kind; they are not of the large class of patterns. That is the general class of patterns that are now making.—[*Exhibiting one.*]

364. This has been woven, I believe, without the Jacquard loom?—Yes.

365. How do you acquire your patterns principally in Spital-fields?—They are almost entirely copies or variations from French patterns; there is but a very small degree of talent employed in Spital-fields in the production of patterns. We are almost destitute of original taste in that particular department.

366. In reality your patterns that are called British patterns, are the greater part copies, or little more?—Variations from French patterns.

367. Are there persons who devote themselves to the drawing patterns or copying French patterns in Spital-fields?—There are.

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368. What description of persons are they?—They are not persons of any education, and very little cultivation of taste, I should say.

369. Is their attention confined chiefly to the copying French patterns, or other than French patterns?—No, the French patterns are generally given to them by the manufacturers, and they either copy precisely or make variations as the manufacturers or their own taste may suggest.

370. Have these persons been educated as artists in any degree?—I believe not, or very rarely; I am not acquainted with any drawer of patterns who is an educated artist.

371. Do they make a good living by it; is it a thing from which they derive much emolument?—A moderate income.

372. A fair remuneration; how much do they get?—Probably a man may obtain from 100*l.* to 200*l.* a year.

373. A good pattern-drawer?—Yes.

374. Are you aware, or have you any objection to state, what is considered among the master manufacturers of Spital-fields a large or small sum, or an average sum, for paying these men?—It will depend entirely on the nature of the pattern; it generally happens that the person who draws a pattern also prepares it for its being inserted in the loom; so that the price paid to the pattern-drawer includes some operation of the machinery employed in putting it to work.

375. Are you aware that the French profession of artist is wholly distinct from the profession of reducing the pattern to the Jacquard loom, or adapting it to the Jacquard loom?—I am aware of it.

376. You have not stated any sum that is given to these persons, but you say it varies according to circumstances?—According to the description of pattern.

377. And it is also mixed up with a remuneration given for reducing the design to the mould, or cutting the card, which is necessary for the weaving it in the looms?—It is so.

378. The auxiliary branch of the business is purely mechanical, the cutting of the card?—Quite so, an operation of machinery.

379. It is not necessary that a person should be an artist to enable him to cut the card of a pattern?—By no means.

380. If there was, on the one hand, any Legislative protection for patterns, and on the other there were drawers of patterns who were skilful artists, who could draw beautiful patterns, is it your opinion from the consumption and appreciation by the public of beautiful works of art as applied to silk manufacture, that the master manufacturers would be enabled to give larger prices for patterns, and to have specimens of greater beauty, and consequently to encourage a better description of pattern-drawer than we have at present?—It is quite my opinion; I think that the two difficulties under which we labour at present, are, first, that we have no protection for patterns, so that if I make an outlay of from 20*l.* to 100*l.* upon a pattern, it may be pirated to-morrow by my neighbour, and I should have no compensation for it; and the second difficulty is, that we have no national taste in this department of art, that we have no originality in design in drawing of patterns, that we are compelled to make copies from French patterns in order to supply the demands of our customers.

381. Then from what you have already said it is also your opinion that a school of arts open to persons connected with the manufacture of the country would be of high value and importance?—I think it would be of the greatest importance, coupled with the protection of patterns; but without a protection of patterns, no school of design would be of any advantage to us.

382. The two instruments for encouraging the improvement of patterns are instruction and protection?—Yes.

383. Does any thing occur to you which you think would be useful to the Committee, as to how the machinery of this school could be best managed?—I think I can only refer to Dr. Bowring's evidence as the gentlemen who have preceded me have done. Some such plan as that adopted in France would be the best for us.

384. Do you think, for instance, that there would be a disposition in the master manufacturers to contribute to any such establishment or institution?—Yes; I feel quite convinced that it is not to be expected that the master manufacturers would undertake any part of the expense of such an establishment. That the utmost that could be expected from them, would be to give their time and attention to the arrangement and working of the system; and I believe the fact is, that in France the

the government, or the municipal authorities, or both together, do pay for the whole cost of the establishment.

385. You have stated, that there is a great improvement in the national taste; do you attribute that to any other circumstance than the introduction of foreign manufactures, which show a superior taste?—No; I do not attribute it, in our particular branch of the manufacture, to any other circumstance.

386. You have mentioned, too, protection to the inventor, the instruction of the artist, and the spreading of knowledge in designs among the manufacturing population; do you think having galleries and giving people every opportunity of seeing beautiful specimens of art, and useful means of encouraging taste in design, would be of service?—I am of opinion that if the general taste of the nation was improved it would be beneficial to our manufactures; and I would add that ours is a manufacture which is capable of such extreme variety in shades of colour, in the blending of shades, and in producing various forms of pattern, that there is hardly any one to which the exhibition of all works of art in which colours are concerned would be more beneficial.

387. For how long a period do you think it necessary to leave a protection for patterns?—I think not less than 12 months.

388. You are aware that the protection at present for printed cottons is three months?—Yes. I am also aware that there is a complaint that the protection is not sufficiently long.

389. Would you not think it sufficiently long if a pattern was protected during a season, either the spring or winter season, for six months?—I can give a reason why this would not be a sufficient time. I was manufacturing a pattern in silk during the spring, to the order of a large house of business in London. I received orders from them to continue the manufacture of the same pattern in autumn colours; but in the last month this pattern was taken to Manchester and manufactured there. The order which I had received for the winter article was immediately countermanded, because it was produced at Manchester at a much less price.

390. You have stated that you get most of your ideas at present from the French; have you not regular pattern-drawers in the silk trade?—I have already stated that we have.

391. Suppose a means could be found of creating a tribunal of taste in regard to patterns, what species of penalty would you apply to the infraction of a copy-right?—I think a fine might be made sufficiently heavy to deter piracy. In France there is imprisonment also.

392. In France they have the power of imprisonment for three days, and of fining to the amount of, I think, about 8*l.* sterling; do you think that penalty would be sufficient?—By no means.

393. Would you not also recommend the seizure of the goods of which the copy-right had been pirated?—I should prefer to make the fine considerably heavier, and I believe I shall be borne out in this from what takes place in the cotton trade. It has always been found that an injunction in the Court of Chancery has been sufficient to protect a pattern of printed goods.

394. There would be no objection to give a body, constituted for the purpose of protecting copy-rights, a power of fining to any extent, supposing there was an appeal?—I should say no objection.

395. Is it not important that the remedy for infraction of patent right should be cheap as well as summary and prompt?—Most decidedly so; if it did not combine the two objects of cheapness and promptitude in protection to the patterns, it would be quite ineffectual.

396. Is it not the case that sometimes there are more than 100 pieces of the same pattern?—It more often happens that there are less than 100; more often than not.

397. According to the average returns from the Chamber of Commerce at Lyons, the number of pieces made of fancy goods of particular patterns does not exceed 20 from the frame; what is the average production of England of the same manufacture?—I have no precise knowledge of that; I should say double; at least 40.

398. Are you aware of the fact, that in some cases a very large profit is paid to manufacturers on condition that they shall produce a small number, and then destroy the design?—That does not take place in this country.

399. Have you heard that that is very frequently the case in orders given for French silks?—I have.

400. Supposing a protection to be afforded to a pattern, how would you have it effected;

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effected ; for instance, in a pattern to be made ready for sale to-morrow, what protection would you afford to it before it went into the market?—By registering the actual pattern.

401. Would you have something put at the end to signify that it was an engaged pattern for a specific time?—I think that registration would be a sufficient protection.

402. With regard to printed goods, the custom is for the parties to print on the end, “engaged for three months,” and after that period it may be copied by any body; do you think that would be a sufficient protection?—I think it would be so, if it was extended, as I said before, to 12 months; whatever registration took place should be a public and authentic one.

403. Would not the registration and location of patterns, representing the state of protection in the particular trade, be in itself a great means of advancing and improving the manufacture?—I think it would be influential.

404. Would you have a central place for registration?—I think that would be questionable.

405. Do not you think the simple mode adopted in printing cotton, of having written on or woven at the end of the piece, “registered on such a day,” and sending a copy of the pattern to an office with that statement, would be sufficient?—I think that would be a sufficient protection.

406. You have the intimation that it is an engaged pattern, and if it is doubted, reference can be made to the register at the office?—I think that would be a sufficient protection.

407. Has the system of registration adopted as to printed cottons succeeded?—I believe it has succeeded entirely.

408. The number of printed cottons is very large, and it is said that the average production of fancy silk goods is very small; do you think the cases are quite analogous?—I am not aware that this circumstance would affect the case in any manner.

409. Is the stamping the piece itself any security?—I am not prepared to say that stamping is necessary; simple registration of the actual pattern, with the date, would be sufficient protection to any manufacture.

410. Are there in this country any superior weavers who are solely employed in the weaving of patterns?—There are not, and there is a good reason why this is so; a weaver could not himself produce the pattern to the manufacturer in the same way as he does at Lyons, because in London he is not possessed of machinery by which he could do it; the machinery belongs to the master manufacturer here, but in Lyons it belongs to the weaver.

411. Does it not frequently happen in France, that after the design has been produced, the weaver introduces a considerable modification into the pattern itself?—I have heard it so stated.

412. And have you also heard it stated, that a great many patterns produced by the artist, and worked by the pattern-weaver, are not brought into the market, as they are considered to have failed in the experiment?—Yes, I have heard that it is so.

Mr. John Howell and Mr. Robert Butt, called in; and Examined.

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Mr. Robert Butt.

413. MR. HOWELL, you are a partner in the well-known firm of Messrs. Howell & James, Regent-street?—Yes.

414. Mr. Butt, are you in the same establishment?—Yes, I am principal manager of the bronze and porcelain department of Messrs. Howell & James's establishment.

415. Mr. Howell.]—Of course you are extensively acquainted with the subject of patterns; will you have the goodness to lay before the Committee any information that you possess upon that subject?—A question was put to the last witness, as to the manner of choosing our patterns or goods; it is usual for the Lyons manufacturers to come twice a year to England, that is, in the spring for the autumn, and the autumn for the spring, and they produce perhaps 200 or 300 patterns, not paper patterns, but silk patterns or gauze patterns, or whatever it may be, and from these patterns we make our selection; and it sometimes happens that we have so good an opinion of certain patterns, that we say, “Now you must withdraw that, it must be made for us only,” and for 20 or 30 pieces they will do that. Now the English manufacturers never give us that advantage, they think it very expensive to put to work a pattern to show us the effect of it, for it looks so different on paper to what it is in reality, that we cannot decide whether

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whether we shall have it or not, and we often urge them to bring us a little piece ready, to see the effect of it; sometimes we want colour, sometimes we want a little change in the disposition; but there has always been an objection to the expense incurred, and therefore we are obliged to bear the expense if we are content to order from a paper pattern; we have sometimes found it necessary to ask for a pattern-drawer or designer; not a pattern-drawer, because they are distinct businesses.

416. Do you mean in England?—Yes; I never found a good designer in England; a pattern-drawer is a different thing altogether; he is the man who puts the thing comparatively to work, as an architect designs the building of a house.

417. You say you found it very difficult to procure a good designer in England; is it equally as difficult to find a good pattern-drawer?—I cannot procure either; you must have attached to the establishment a pattern-drawer as well as a designer; a pattern-drawer is the man who puts it to work.

418. But you can get neither of them?—No.

419. Neither a good pattern-drawer nor a good designer?—No; the designer gives us a small pattern, and the pattern-drawer is the person who prepares the work; as an architect gives a drawing to the builder, so does the designer to the pattern-drawer.

420. You mean by alluding to pattern-drawers, if I understand you correctly, that persons cannot construct a loom so well in this country to work a pattern, as they can in France?—I think there are not so many persons that are capable of doing it in this country as in France.

421. That is the department of weaver?—Yes; but I believe there are persons present who will give better information on that point; I understand the pattern-drawer and designer, one depends upon the other; the pattern-drawer is the medium between the designer and the weaver.

422. Have you any other observations to offer on the subject of patterns?—Nothing material.

423. Do you consider that the French figured and fancy goods are superior in design to those produced in this country?—After the Peace with France, I found the manufactures of France were superior to those of England; I mean in regard to silks of all descriptions; but I think a great deal of that arose out of having made use of better material; the natural silk of France has been considered better than any other country, but now we have an importation of that natural silk, and it is manufactured here.

424. Do you think the importation of raw silk from France, by reason of its superior quality, has beneficially acted upon the English manufacture?—I think it has; I found their silks better the moment I had an opportunity to go and see them; but I have found them declining every day since; every time I go to France I find the French silks are not so good as they used to be in point of material and workmanship; they appear to be desirous of a large trade rather than a small good trade; the English manufacture has improved in a greater ratio perhaps since then.

425. Confine the question to design, not to material or workmanship?—France is superior to us in design; they continue to be superior; but it is confined to very few houses; there is only one house at Lyons we can deal with largely, because their taste is always superior; I am speaking of design.

426. Has there been a great improvement in English colours of late years?—I think there has.

427. And a general improvement in all arts and productions?—Certainly.

428. You have just said that French manufactures are declining with regard to superiority; do you consider that to proceed from the increased competition offered by this country?—I think it is from less encouragement given by this country; it has been very little, compared with the improvements; two-thirds of the silk we are now selling are English.

429. You have also mentioned that the French fabrics are superior to ours; are you aware that there are schools of design in France for the education of persons?—I have understood so.

430. Do you not know that the superiority of design is produced in a great measure from the encouragement given to learn designing as a matter of art?—That is my opinion.

431. Suppose in France you want to engage a pattern, and you give an order for

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for 20 or 30 pieces, do you pay a price in proportion to the quantity you take of it?—I presume they put a per centage on it in the first instance; the patterns are brought ready made.

432. Have you had occasion to find it your interest to get French patterns copied by manufacturers in this country?—Frequently, with a little variation; in fact, we keep all our patterns; patterns 50 years old are very useful to us at this present moment.

433. You get them made in this country because you get them made cheaper than in France?—Yes, without duty; but whether I could get them cheaper or not, I would not send patterns from England to France to be made; I should give the preference to this country as a matter of conscience.

434. The question is, whether you get French patterns made by English manufacturers; that is to say, you buy patterns of a French manufacturer at Lyons, say five or ten pieces, and you find a sale for them all, and wanted more, would you send that pattern to Spital-fields to imitate?—Yes, when I wanted a repetition of it.

435. Do you think it desirable to extend a knowledge of design among the population?—I do.

436. Do you think it wanted?—I think it wanted, coupled with a protection to patterns.

437. The protection to patterns is not only important to the manufacturer, but important to the seller?—Yes; to me particularly.

438. Now do not you consider in another branch of trade, that our designs in jewellery are better than in France?—If the Committee is inclined to commence that subject, I can answer any question.

439. Have the goodness to embody any information as clearly as you possibly can, when you have done with the subject upon silk?—With respect to protection to trade, Mr. Gibson stated a twelvemonth; I should be quite satisfied with six.

440. With respect to the invention of patterns, you think that would be quite sufficient?—Yes, six months; and I think the mere stamping the name on the end of the piece, added to the registering, would answer all purposes.

441. Do you know whether or not the riband trade is improving in this country?—I consider that is a particular sort of riband which the English manufacturer could not succeed in making, is now going out of fashion; the gauze riband de coupé and the other introductions they can make very well.

442. With regard to shawls?—The French machinery of India shawls is superior to any we have in this country, and it has been brought about by Ternaux going to Cachmere, and bringing over with him some of the Cachmere goats.

443. Are you aware that the factory system has been applied to the production of shawls in France?—I am not aware of it.

444. Do the French pay great attention to pattern shawls?—Very great attention; they will give three or four hundred pounds for a Cachmere shawl, or India shawl, for the sake of the pattern.

445. Had you an opportunity of seeing the shawls that were exhibited at the Exposition in France?—Yes.

446. Was there not a universal acknowledgement of great superiority?—Certainly they are superior to the India shawls; the patterns are more perfect.

447. Are you aware that not only has the French shawl manufacture not only improved in beauty, but that there has been an extraordinary diminution in price?—Certainly, even as to the Cachmere materials, there has been a great diminution.

448. A diminution amounting to nearly 60 per cent?—Yes.

449. Can a French manufacturer produce a superior article to the English manufacturer at the same price?—Certainly.

450. Do you attribute their superiority to having a superiority of materials for dying, or to the construction?—No, because we have the same material; I consider it is in the manufacturing part of it; it is not for want of the same materials; I believe, in the first place, greater encouragement is given to the French people in the manufacture of shawls than to the English.

451. Are their patterns superior by superiority of combination of colours, or design?—Yes, in the manufacture, as well as the combination of colours and design, it is all superior.

452. You attribute the encouragement given in France to the superiority of design; are you aware that improvement in the quality and diminution in price

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price has led to a great increase of demand in France generally for shawls?—I should consider it had.

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453. Are you also aware of the fact, that the importation from the East Indies, which was formerly very considerable, is very much diminished in France, though shawls are now admitted which were formerly prohibited?—I should consider it is diminished very much, and in this country too.

454. Have they a superiority of machinery in the manufacture?—I believe they have, and execution as well. Will the Committee allow me to exhibit some pieces of paper, to elucidate the connexion between silk and other materials, the manufactures of the country? It shows how the introduction of good patterns will give a taste or style to other materials; it is intended for rooms in lieu of silk; and instead of costing two guineas and a half, a yard would only cost 2s. 6d. The inventors are De la Rue & Company, Bunhill Row.—[Mr. Howell then produced to the Committee patterns of various colours.]

Mr. Robert Harrison, called in; and Examined.

455. YOU are connected with the respectable firm of Brydges, Campbell & Harrison, silk manufacturers?—I am.

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456. Have you been long in that business?—Yes; I have been connected with it for these last 20 years.

457. Has your attention been turned to the superiority or inferiority of the French patterns in the silk trade?—My attention principally has been devoted to the better branches in the manufacturing of fancy silks.

458. In those branches do you find a superiority or inferiority to the English in the designs and patterns?—In designs and patterns we are very inferior to them; and that is the principal difficulty under which we labour at the present time.

459. Do you refer to other fancy articles, as well as silk?—It is silk we devote our attention entirely to; we have not been able to find persons in this country who are capable of giving proper designs; the principal difficulty arises from the circumstance of men not having been brought up in this country to design for silk; it is very different to designing for printers, from the circumstance that it is necessary a man should be conversant with the principle of weaving, before he can make a proper design for silk. If we could only get designs in this country, we should be able to find parties that could put them on ruled paper for weaving.

460. You mean by ruled paper, the paper which goes between the original invention of the pattern and the manufacture of it?—Yes, the person who cuts the cards, according to the construction of our machinery; there is nothing but what we could make, provided we had a proper designer for the purpose of drawing patterns for weaving; and I think the principal difficulty arises from the circumstance of not having any school of art in this country, where young men would be enabled to pursue their studies for the purpose of perfecting themselves in drawing for that particular branch of the manufacture.

461. You think there is no want of talent in the country?—I think there is not; because there are a great many persons engaged exclusively in the production of designs for printed cottons, challis, and bandanas; we have in the trade individuals who can draw patterns, but are not conversant with the principle of weaving, and therefore we have been unable to put those patterns to work. We have now many patterns by us which are perfectly useless, because the drawing is not adapted to weaving.

462. You think, also, that not only the talent of the artist, but the taste of the public, would be encouraged by such good designs, if they really existed?—Undoubtedly; because it is from the superiority of the design that the French have the advantage over us.

463. And you think that the encouragement of knowledge of design, by whatever means, among the manufacturing population, would extend the demand of the manufacture?—Undoubtedly it would; we would willingly, at the present time, engage a man at a handsome salary, conversant with the principle of weaving, as a designer, and also able to put the pattern upon paper.

464. Has encouragement been given to foreigners possessing the best quality and knowledge of design, and superiority in weaving, to come over here?—Two or three have been over here at various times; but we have not been able to meet with individuals capable of carrying on the designing of patterns and drawing also, to the extent we should wish; I imagine those men are able to get sufficient occupation in Lyons or in France, without coming to this country.

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465. Do you consider them to be superior even in original design, in that portion of the manufacture connected with the art, as well as embodying the art of manufacture in the process of weaving?—I think their superiority arises from the circumstance of their having a knowledge of weaving as well as a power of designing.

466. You consider them superior in both?—Decidedly, in designing, from their knowledge of the principle of weaving.

467. Do you consider our deficiency in the means of not having persons in this country to construct designs, and also to have a knowledge of the looms, to be such that you yourself would be anxious to engage foreigners to come over here in that department, provided you could get them?—Yes, I should be very willing to do so. I feel satisfied we could make anything in this country, provided we had proper designers, parties to make drawings, and put the drawings upon ruled paper ready for cutting of the cards.

468. And do you think if such persons did exist in this country, it would be a source of profitable employment?—I think it would.

469. And the trade suffers for want of it?—Certainly, for the want of it. I have one or two patterns with me that we had drawn in Paris, and immediately we got them over here, we had not the least difficulty in putting them to work.—*[The Witness handed in some patterns.]*

470. These patterns are such as you have described already, that have been tried on the loom; and found they would succeed?—We can pretty well judge by the style of drawing, whether it would succeed when put upon rolled paper, that is, if it is done by a person who is conversant with weaving.

471. Do you consider foreigners superior to us in their colours?—I do not think they are; there is a brightness in their colours we certainly do not possess, but I think our colours are more permanent.

472. Do you think we have improved?—The dying of colours has certainly improved within the last few years, and in many cases, the permanency of colours decidedly is more so than the French.

473. Is there not a chemical combination entered into in the different colours?—It is necessary to have a perfect chemical knowledge before a man can be a good dyer.

474. What is the cause of the peculiar brilliancy in the French colour?—I scarcely can answer that question; I understand it arises from the climate more than anything else, and the water has something to do with it as well.

475. Have you anything that you desire to suggest with regard to the encouragement of designs; have you paid particular attention to that?—It has occurred to me, if we had a school of arts established in this country, that a great many young men would be willing to make themselves conversant with the principle of weaving, for the purpose of procuring that particular study, and ultimately to become designers and drawers upon ruled paper for the silk trade.

476. Would it not be a lucrative profession for those young men?—I think it would, decidedly.

477. Have you turned your attention to the subject of protection?—We have often felt the necessity of having some protection for our patterns. Only about four months since, a figured silk made for a house at the west end of the town, about a week after sending the order in we found the pattern copied in Spital-fields; we in fact bought the identical piece of silk copied from the one we had made to a particular order; it was of a very inferior quality, and consequently came to 1s. 6d. per yard less.

478. Have you turned your attention to the best means of carrying into effect a security for a new pattern?—I am not exactly aware of the system, or rather the plan pursued at Lyons, but I am given to understand that a system does exist there; and I should imagine if we could establish the same principle in this country, it would be the most effective means of protecting us.

479. Do you mean by adopting the marking or registration?—I think simple registration would be sufficient.

480. Have you any other point connected with your own manufacture to offer to the Committee?—Nothing more.

481. Do not you think that registration would be more complete if the piece was marked at the end with the date of registration?—Immediately the piece leaves our hands it would go into a house at the west end of the town, and they would instantly cut off that mark; I do not see any good likely to result from it.

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Veneris, 7^o die Augusti, 1835.

WILLIAM EWART, ESQUIRE, IN THE CHAIR.

Mr. George Eld, called in; and Examined.

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482. I BELIEVE you are mayor of Coventry at present?—I am.

483. Have you resided many years in that neighbourhood?—Yes, I was born in Coventry, and I have resided at Foleshill, which is in the county of Coventry, and within three miles of it, for the last 20 years.

484. You are not, I believe, engaged in trade yourself?—I am not engaged in the riband trade.

485. In what trade are you engaged?—In the corn trade.

486. But from your residence in the neighbourhood of Coventry you are acquainted with the state of the riband manufacture?—Yes; I reside at Foleshill which is inhabited almost exclusively by a manufacturing population.

487. You have been an observer of the state of the manufacturing population of that neighbourhood?—Yes; in consequence of the distress under which they have been suffering of late, my attention has been called to the condition of the operative weavers in the riband trade.

488. Have you ever had occasion to observe that the operative weavers employed in the riband trade in that neighbourhood would derive advantage from improved skill in designing patterns, and from a knowledge of the arts?—Such improved skill appears to me to be very much required indeed. In consequence of the public attention having been directed to that subject, I made some inquiry with a view to ascertain the number of persons engaged in the riband trade, and who had any knowledge of the art of design in Foleshill; with a population of 7,000, I could not find more than six persons in the whole parish who were capable of copying a pattern, and not one capable of making an original design.

489. You have made exact inquiries into that subject?—Yes, as far as I have been able to do so.

490. Is there any school of design established in that neighbourhood?—None whatever.

491. Not even connected with the Mechanics' Institution?—Not at Foleshill. At Coventry there is a drawing class connected with the Mechanics' Institution of that town, but it is as yet quite in its infancy.

492. Is that drawing class at Coventry open to every body?—Only to the subscribers to the institution, of course.

493. Have the inhabitants of Foleshill, to your knowledge, ever presented any petition to Parliament connected with this subject?—Yes, they presented a petition in which they prayed for assistance towards establishing a school of design as connected with the riband manufacture.

494. In your opinion is it the general conviction of the residents in the neighbourhood, that the time has come when such establishments would be of peculiar utility in the improvement of that manufacture?—Certainly; I have had frequent conversations with the manufacturers of Coventry upon that subject, and they appear to me to desire such an establishment very much.

495. To what circumstance do you attribute the change which has taken place in the conviction as to the importance of a knowledge of art with reference to manufactures?—I should say from the decided superiority of the French in the taste of their patterns, which has forced upon them the conviction that they must adopt the same means of cultivating a better taste.

496. Has that become a general conviction in the neighbourhood of Coventry and Foleshill?—Yes.

497. Has that conviction prevailed among the operative weavers, as well as the master manufacturers?—Certainly.

498. In your opinion would the operative weavers avail themselves of such means of improving their taste and knowledge of art if those means could be afforded?—Yes, I think so certainly, and I may mention as an instance of that,

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that I was conversing one day with a weaver in Foleshill, and stating to him my wish to see the establishment of some school of design in that neighbourhood; he said it would be a good thing, and the next morning his nephew waited upon me; he said his uncle had mentioned our conversation to him, and he very much wished that something of the sort should be established. He brought with him some patterns which he had made himself, and was anxious that I should assist in setting on foot something of the sort in Foleshill; a register of patterns; or in short, to establish a school of design.

499. With reference to the Mechanics' Institution of Coventry, and the teaching of drawing there, do you know whether the teaching of drawing is accompanied by any instruction as to the transfer of the drawn pattern to manufactured articles?—I do not think it is, but I am not able to speak to that, not being a member of the institution myself.

500. You are aware that that would be a necessary part of the instruction to be afforded by a school of design with reference to manufactures?—Yes, a mere drawing school would be of very little use, unless it was accompanied by lectures on the art of drawing and design, as applicable to manufactures, and as showing the means of transferring the design to the article to be produced.

501. Are you aware that at present new patterns are invented at Coventry and Foleshill?—I think very few original patterns are invented; but not being a manufacturer myself, I cannot speak very accurately to that.

502. You have stated that there is a conviction on the part of the operative weavers that such establishments would be of utility to them?—Yes.

503. There is a willingness therefore on their part to improve their taste and to acquire a greater knowledge of the arts?—Certainly.

504. Do you conceive there is any want of native talent, if properly encouraged?—None at all.

505. In fact, then, in your opinion, it is only doing justice to the natural talents of the manufacturing population to give them the means of acquiring a better knowledge of the art of design?—Certainly.

506. Do you think, if some encouragement were given by Government or by Parliament for the establishment of schools of art in certain districts, that local assistance might also be obtained for the same object?—Yes, I think so, certainly.

507. You think there would be no unwillingness to assist, on the part of the inhabitants of those districts?—I think there would be great willingness.

508. Have you any public collection of pictures at Coventry or Foleshill?—No, there is none at Coventry, and Foleshill is a mere village, with very few opulent inhabitants.

509. Then the manufacturing artist has no external means of acquiring a taste in the art of painting?—No.

510. Is there any museum for patterns at Coventry?—No.

511. Or of machines?—No.

512. Is botany a study at all attended to by the manufacturing weavers?—No; there are some collections of natural history, principally of birds, at Coventry; but I have not heard that they have turned their attention to botany at all.

513. Have they any means of acquiring a knowledge of the effect of a combination of colours?—No.

514. Is chemistry a science which is at all attended to by the operative weavers?—No.

515. Is it not attended to by the dyers?—I do not know.

516. In your opinion is there a sufficient number of opulent inhabitants in Foleshill to establish institutions to promote instruction in the arts among the manufacturing population?—I think not.

517. Is there a sufficient number of such persons in Coventry?—At Coventry I think very material assistance could be derived, not only from the opulent inhabitants, but from the established school in that place. There is a school called Bablake School, which is under the patronage of the corporation, in which I think drawing and design, as applicable to manufactures, might very easily be introduced.

518. Is it your opinion that in this country, as in France, there might be, in addition to the encouragement afforded by the Government, some assistance derived from funds at the disposal of the municipalities, which might be very advantageously applied to the acquirement of that knowledge on the part of the manufacturers?—I think the funds at the disposal of Government would very much assist, with the aid of the local institutions, such as Bablake School, in which, if the boys could

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could be taught the arts connected with the occupations in which they are afterwards to be engaged, it would be very advantageous.

519. At present the arts are not taught in any public or charity school in Coventry?—No.

520. Are you of opinion that if aid were received from Government it would encourage the voluntary system?—Yes; there is no voluntary system at present.

521. Did you not state that there was a Mechanics' Institution?—Yes, but that is not a school of art; that is a mere drawing class.

522. Is not that supported by voluntary contributions?—Yes, but it is not able to carry on such a system of teaching, applicable to manufactures, as can be of any importance.

523. Do you not think that the existence of a drawing class in the Mechanics' Institution at Coventry, is a proof of the willingness on the part of the inhabitants to assist the views of Government in the establishment of such institutions?—Yes.

524. In your opinion, would the assistance that could be given by Government, or from the capital, not only be important in a pecuniary point of view, but also very important with a view to give a proper direction to the study?—Certainly.

525. Are you aware that school-houses are founded now by facilities given on the part of the Government, and not by direct interference?—Yes.

526. Do you think some such plan might be usefully adopted with reference to schools of design?—I think it might.

527. Do you think it might be desirable to have any thing like normal schools to instruct the teachers themselves, and that thus a uniformity of knowledge might be supplied all over the country?—It certainly would be very useful as applicable to the neighbourhood of Coventry.

528. Do you think there should be a central school of art for the instruction of teachers?—Yes, it would be very useful, as it would provide for a general direction of the schools.

529. Would not instructors, taught in London, from the circumstances of the immensity of the population, the number of public galleries, and the habitual intercourse that exists among individuals of all nations, have superior facilities for acquiring knowledge in all branches of art?—Certainly.

530. Would not such persons be likely to be better instructors in the provinces than persons merely educated in the provinces?—Certainly.

531. Have you ever turned your attention to the subject of the protection afforded to the inventions of artists?—I have not, but it appears to me that it is of very little use to teach them to design patterns, unless you protect them in the use of that design after it is made.

532. In your opinion it is necessary to afford that protection in order to encourage the invention of new designs?—I think so.

533. Do you think it would be easy to establish a board or tribunal for masters and workmen, to whom questions relating to the copyright of patterns might very conveniently be referred?—I think so.

534. Is there any other suggestion which you wish to offer to the Committee?—I am not aware of any at present.

Mr. Robert Butt, called in; and further Examined.

535. DO you belong to the establishment of Messrs. Howell & James, in Regent-street?—I do.

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536. What portion of that establishment do you particularly superintend?—The bronze and porcelain department.

537. How long have you been in that situation?—About two years.

538. Were you well acquainted with the subject which comes under your consideration there, previously to your being a member of that establishment?—Yes, I have been accustomed from boyhood to deal in such things.

539. In London?—Yes, in the houses of other importers of such goods.

540. Was your experience confined to London, or did it extend to other parts of the country?—It was confined to London.

541. You have not been much to Worcester or other places?—I have not.

542. Has your attention been called, from observation, to the comparative merits

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merits of the English and French manufacturers, as regards the design in bronzes and porcelain?—It has.

543. What has been the result of your observations upon that subject?—I consider that, with a few exceptions, in metallic manufactures the French are vastly superior to us in their designs.

544. What are the exceptions to which you allude?—I allude more particularly to manufactures in silver, to gold, jewellery, and to castings in iron, in which I think we excel them in design.

545. With regard to porcelain, which of the two are superior in design, and in what branches of the porcelain manufacture?—In some branches of the porcelain manufacture, the French are superior to us in design, in others they are inferior. In that description of porcelain which is of the same nature as the old Dresden china, ornamented with raised flowers, we are vastly superior to them, and a considerable quantity of such porcelain is, I believe, annually exported to Paris, and is sold there, and considered by the French superior to their own.

546. That is the porcelain in which the designs are in relief?—Exactly; but with that exception, their designs in porcelain are superior to ours.

547. Do you speak merely of the designs of the French in fancy articles of porcelain being superior to ours?—Yes, in ornamental porcelain.

548. You do not speak of those articles in porcelain manufacture which enter into the consumption of the great mass of the population?—I do not.

549. Your observation is confined to articles of luxury and ornaments?—It is.

550. Is it entirely confined to them?—Yes; I have little or no knowledge of the other branches of the porcelain manufacture.

551. In your opinion, the French are superior to us in their designs in bronzes and some other metallic manufactures?—Yes. In the term “bronze,” we include not only that which is strictly bronze, but all articles cast in similar metal, whether gilt, or-molu, or otherwise, such as human figures, figures of animals, and the ornaments of clocks, candelabra, and so on.

552. You have stated, that with respect to articles of silver, gold and iron, the English are superior in their designs to the French; how do you account for the superiority of the English in the one case, and the superiority of the French in the other?—Because the superior costliness of the articles to which I allude in England, as compared with those of France, enables English manufacturers to give high prices to artists to model or design their patterns, particularly in silver.

553. In fact, the costliness of the article calls into the market a supply of a superior degree of artists?—It does.

554. But with respect to articles of an inferior value, the French are superior to us in their designs, from the greater cheapness of art in that country?—Yes.

555. Then is not the possession of cheap art in England, a great desideratum in the manufacture of those articles of a less costly description?—Certainly.

556. In your opinion, in the less costly articles for which art cannot be so highly paid, there is not a sufficient supply of art at a cheap rate for the purposes of the manufacturer?—There is not.

557. For instance; a silversmith who pays highly for a design, and produces a very costly article, could afford to go to a Flaxman or a Stothard, as artists who could furnish a design; but the manufacturer of articles which come within the range of the less opulent classes of consumers could not afford to employ them?—That is precisely my view of the case.

558. They cannot, from the lower price of the articles, afford to pay so highly for art?—Certainly not.

559. Are not articles in bronze of sufficient importance to require the employment of able designers?—They are.

560. How comes it then that you have stated, that in these articles a superiority exists on the part of the French?—Because, although they are articles of sufficient importance to demand the assistance of art in this country, yet they are not of sufficient importance to demand the assistance of art to be paid for at the same rate as it is for manufactures in silver and such costly materials. I mean particularly to allude to the richer description of silver articles manufactured in England. But similar designs for bronze may be obtained at a much lower rate in France.

561. You allude to articles of luxury and ornaments, articles required by the few, and not for the consumption of the many?—I do.

562. But if iron manufactures will pay for the employment of able designers, how comes it that manufactures in bronze will not?—Because castings in iron, such as

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as I allude to, that is for architectural embellishment, have a very extensive sale in this country, and we have no foreign competitors in that branch of manufacture, but for bronzes there is not an extensive sale, and we have the competition of the French to contend with.

563. You have stated that the French are superior in the art of design in certain articles; is there any difference in the manner of moulding between the two countries, and do you think the French mould bronzes better than we do?—I can only speak of the superiority of their designs.

564. In the operative process of moulding, in fusing the metal and preparing the mould to receive it, are they superior to us?—I am not aware that they are; I have no actual knowledge on the subject, but I believe it is not considered that they are.

565. To what cause do you attribute the general excellence of the French in the design of manufactures of certain articles?—To the facilities afforded to persons of all classes in France for acquiring a knowledge of the art of design, and the corresponding difficulty to any but persons of comparative independence of obtaining similar instruction in England.

566. Have you been in France yourself?—I have.

567. Have you had an opportunity of observing what advantage results to the French workman from that superior knowledge of design which you have stated he possesses?—The advantage which arises to the French workman from that knowledge of the art of design which the public institutions of France enable him to obtain, consists in the circumstance that he is thereby enabled frequently to make his own designs and models, and if not sufficiently instructed to do that, he is at all events enabled to finish works executed from the models of others with superior accuracy, so as to give them their proper articulation and feeling, particularly in human figures and figures of animals. I may say, in continuation, that this is rarely the case with English workmen; and the advantages which the former consequently possesses are conspicuous in the beautiful figures which decorate the clocks, candelabra, vases, &c. which are imported from the continent, the grace and expression of which (however well modelled by the artist) would be entirely spoiled by an injudicious finishing of the muscles, draperies and extremities by an ignorant workman.

568. Then your answer tends to show that even in copying the French are superior, because the manufacturing population are better educated in art?—Undoubtedly.

569. And therefore, though the workman might not design himself, he has a more correct idea of the object he is to imitate?—Yes.

570. And he has a more correct idea because he is more of an artist?—Certainly.

571. Have you visited any of those institutions to which you have alluded?—I have not; what I have stated with respect to them is not from personal observation, but I speak of them as of a matter of notoriety.

572. But you spoke of the effect as a thing which you yourself had observed?—Yes, and as resulting from what I have always understood to be the nature of those institutions.

573. And you speak positively as to the effect produced in the designs of certain articles of French manufacture?—I do.

574. In your opinion, in that particular manufacture of bronze, the French very much excel the English, and for the reasons you have stated?—Yes, and also because independently of the workmen being instructed, the manufacturer is enabled to get models of great beauty executed at a reasonable rate, which is one of the causes of the great abundance of beautiful designs in France.

575. Do you not consider that there exists on the part of the public in France an appreciation of lightness and finish in certain articles which the public in this country do not yet understand?—I am inclined to think that the opportunities which the French have of studying the arts must give a certain tone and feeling for them throughout the country; but I do not know that any superiority in that respect exists among the middle class of France as compared with the same class in England. With respect to the upper classes, I do not think the arts can be appreciated in any country more fully than they are in England.

576. Is there a species of silver work which is produced in Spain and Oriental countries called “Filagree work”?—Yes.

577. Is that produced in this country, or is it an object of very considerable sale?

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sale?—There are very good works in silver filagree executed in this country ; as good as Spanish or American, but inferior to the Indian.

578. Does the difference of price induce any importation of silver filagree work?—There is no considerable importation of silver filagree work for sale.

579. Have you been in other countries besides France, and had an opportunity of observing the different education of the people in the arts?—I have been in several of the kingdoms of Germany.

580. Have you had an opportunity there of turning your attention to that subject?—Not as regards the instruction of artists, but as regards the manufactures.

581. What is the result of your observations, as to Germany, for instance?—They are inferior to the French in design, as inferior as we are, or more so, with the exception of the iron works at Berlin.

582. What remedial measures do you think are necessary for putting the English manufacturer on an equal footing with the French with respect to design and a knowledge of art?—The establishment of schools of design on a popular plan, which shall be entirely separate and distinct in constitution and management from any of the academies of painting and sculpture now existing in England ; and in which it should be distinctly understood that the system of instruction to be pursued would not be intended to qualify the pupils for the professions of painting or sculpture, but merely to teach them the arts of designing and modelling with purity and taste, to be afterwards applied to any manufactures which they may themselves practise, or for the direction of the works of others.

583. In what way would such schools operate to improve the manufacturing artists?—In one mode by enabling young men to acquire a sufficient knowledge of the art of design, to qualify them for the double capacity of clerks and draftsmen or modellers in the counting-houses of manufacturers, who would thereby be enabled frequently to vary and improve the designs of their manufactures without much cost ; the great expense of models and drawings by artists being one of the causes of the paucity of design in their patterns at present. I would observe here, that a parallel system obtains in the offices of architects and engineers, where young men are constantly employed in the capacity of clerks and draftsmen. Having gone through a certain probationary study, they are admitted as articled clerks until they acquire a thorough knowledge of their art, and after a certain time receive payment for their services. It would also enable apprentices in certain trades to acquire a knowledge of design, by agreement in their indentures to attend so many times per week at these schools, so that the study of the manipulation of their trades and the art of design might go hand-in-hand and bring both to perfection. I believe that this system is practised in France.

584. Have you been in the habit of visiting or attending the lectures of the schools of design or academies in this country?—I have not.

585. Then you cannot speak of their deficiencies so correctly as if you had attended the schools?—No ; but I do not attribute any inefficiency to them, as far as regards the purpose for which they were instituted, that is, the cultivation of painting and sculpture in the higher walks of art ; but I conceive that a deficiency exists in the want of public schools on a popular plan, for the purposes that I have stated, which at the same time might form elementary seminaries to qualify young artists for the academies already existing. The process by which a knowledge of the arts of painting and sculpture is now acquired is this : a young man receives tuition from a private master ; he draws from the antique at the British Museum for a certain time, and when he shows that he has sufficient talent to qualify him for a student of the Royal Academy he is admitted ; but the expense of acquiring that preliminary knowledge is considerable, and the young artist must also be maintained by his relatives during the time that he is acquiring it.

586. Do you think that much good would result to the manufacturing artists from the formation in different towns of museums and galleries of art to which they could freely resort at all times?—It would of course be indispensably necessary that every school should have connected with it a museum to assist the studies of the pupils.

587. Or, at all events, that there should be such a museum in the town in which the school is established?—Yes.

588. Do you think that open exhibitions of the finest works of all sorts in stone, paintings, bronze, and so on, would have a good effect in manufacturing artists, as giving specimens of the highest works of art?—Undoubtedly.

589. Then

589. Then you think the formation of such institutions also very desirable with the same view?—Very desirable indeed; every school ought to have its museum, the expense of the formation of which would not be great, for casts from the antique statues, busts, vases, candelabra, gems, coins, and so on, would answer the purpose very well. Such a museum ought to be open to the public under certain limitations, to prevent their interfering with the studies of the scholars. There can be no doubt that it would be of the greatest benefit to the manufactures of this country by improving the taste of minor artists and workmen.

590. Have you ever turned your attention to the propriety of increasing the security of the copyright in models and designs of manufactures, so as to secure the privilege to the inventor for a certain period?—I have.

591. What do you feel to be defective in the present state of the law upon that subject?—The Acts of Parliament existing, as far as I know, on the subject of copyright in models or casts from models afford protection to a certain extent, but the objection is, that they do not go far enough.

592. Will you state, as a person conversant with the arts as applied to manufactures, in what respect you feel that the present law is defective?—In this respect, the protection afforded by the law to models or casts in bronze and other metals extends only to such designs as represent human figures, or figures of animals, or part or parts of such figures.

593. Will you state in what instances you principally find a want of protection?—I may state, for example, that however beautiful the design may be, if it be merely a model of *Arabesque* scrolls or foliage of any description introduced into any work, such as clocks, candelabra, &c., there is no protection for it; it may be pirated with impunity.

594. What protection does the artist enjoy in the case of designs which include human figures or the figures of animals?—He can recover, by an action at law, damages for any infringement of his copyright in that model.

595. How long does his copyright last?—In the first place, for a term of 14 years, and for a further term of 14 years in case he be still living at the expiration of the first term, and has not sold his copyright. That is the law at present under the Acts of the 38 George III. chapter 71, and the 54 George III. chapter 56. By the last Act the protection given by the 38 George III. to models of human figures or of animals, was extended to human figures clothed in drapery or otherwise, and combinations of the human figure with parts of the figures of animals, and also to any subject being matter of invention in sculpture. It is very difficult to ascertain the true construction to be put upon the words "being matter of invention in sculpture," but my opinion is that they would not extend to guarantee the copyright of any model of scroll work, &c. cast in metal, as in the instance of the iron gates of the royal entrance to Buckingham Palace at Hyde Park corner, which are remarkably beautiful. Now I apprehend that if casts or impressions were to be clandestinely taken from those gates, and another pair similar in all respects, but with the omission of the royal arms, were to be thereby made and sold, and the proprietors of the model were to bring an action for the piracy, it would be contended that there was no copyright in the design, as it would not consist of models of any part of the human figure or the figure of animals. Moreover, as it could be easily proved that the models of those gates were originally made in wax, clay or some plastic material, and then cast by the founder in iron, it would be held that there was no sculpture in the matter, and that therefore they could not come within the meaning of the words "matter of invention in sculpture."

596. In fact they are not protected under either of the predicaments mentioned in the Act, either as designs of the human figure or figures of animals, or as matter of invention or sculpture?—Certainly not, and therefore they might be imitated, provided the King's Arms, which of course contains representations of animals, were omitted.

597. Then the only protection afforded to the inventor of the design of those gates is the introduction of the animals in the King's Arms?—Yes, as far as regards the animals, but I conceive that even that does not protect the rest of the design; for if the Royal Arms were omitted, the protection would not extend to the gates, for no one could then say that the copies contained any figures of animals.

598. Does the imperfection of which you speak apply to the artist who invents the pattern in which the mould is made?—The imperfection applies to the proprietor of the model, whether he be the artist, or whether he has purchased it from the artist. By the copyright of a model is of course understood the exclusive

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privilege of making copies or casts from that model, which a manufacturer may purchase from the artist.

599. Do you consider that the inventor of models which come within the Acts of Parliament as representing human figures or figures of animals, is sufficiently protected by the present law?—I think he is.

600. Do you think that would be the opinion of such a designer himself?—I do.

601. Have you reason to believe from your conversation with such inventors of designs, that they consider themselves sufficiently protected?—I have, but the objection is that they can claim no protection for other designs.

602. Then would your suggestion for the amendment of the law in that respect, be to extend the same privilege to the inventors of designs in metal not including the human figure or figures of animals, as is now extended to designs which do include them?—Yes, that the protection should be extended to all original models whether representing any object in nature, or being mere fanciful designs.

603. Is an artist in France who makes fanciful *Arabesque* designs, as you have mentioned, more effectually protected than the artist in England?—I believe he is.

604. You have stated that in England the copyright is protected for 14 years, and at the end of that time for a second term of 14 years to the artist, if he be still living, and has not sold his copyright; do you not consider that too long a period with a view to afford the inventor a fair protection, and at the same time with a view to the interests of the public?—I think not, because articles of the nature of which I have been speaking do not sell rapidly; at first the manufacturer will sell but few, and it is only when they become known that he is repaid for his outlay.

605. Then, in fact, you consider that that protection is not too great, and that it should be extended to all models which do or do not contain human figures, or figures of animals?—Yes, I do.

606. Have you turned your attention, not only to the term of the duration of such copyrights, but to the best plan of recording new designs and models in England; for instance, by registration, by stamps, or by such other means as have often been suggested by different persons interested in the question?—I have. I would suggest that offices of registration or depositories of original designs should be established in the principal towns of the kingdom, where artists or proprietors of new models should deposit a correct drawing or copy of that model, accompanied with a declaration or affidavit of the artist or proprietor, that it is really a new model, and is his property. With respect to the stamps or marks on castings, taken from those models, the plan now adopted under the Act of Parliament is to stamp the name of the proprietor and the date in every such casting previously to publication for sale; but this mode is extremely inconvenient, and it would be a great disfigurement for small castings of figures, or otherwise, to have so large a stamp as would be required on them. It would, I think, answer the purpose better if to every drawing deposited a number were attached at the office; and that the manufacturer should be required to stamp his article with that number, and a letter which should stand for the name of the town in which it was registered, as A might be London; B, Manchester; C, Birmingham, and so on.

607. A kind of index, in fact?—Exactly; and by using the letters of the alphabet in the Roman, Italian and English characters, and those doubled by taking the capital and small letters, we should have 124 towns, many more than would be required for registration in the kingdom. In order to facilitate the understanding of these marks, it would be essential to the public that a key to the letters, that is, a list of towns and their distinguishing characters, should be exhibited in some public part of every office of registration. By that arrangement it would be easy to ascertain whether the models were really registered or not, which would be necessary to prevent persons from stamping their works without taking the trouble to register them, and from passing off copies of old models as new and original ones.

608. Do you know whether such a mode of registration exists with respect to any original designs upon the continent?—I have understood that such a mode of registration exists in France, by depositing drawings of models, but I believe the other part of the plan I have stated is new.

609. The numbering and the alphabetical key to the register is your own idea?

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—It is; the intention of that is merely to do away with the disfigurement of small castings by so large a stamp as would be required for a name and date.

610. Do you not think there would be a great difficulty in protecting the copyright of models in cases not of an exact copy, but of so near an imitation that one might sell as well as the other; for instance, a figure of Apollo, by altering the posture in the slightest degree, or putting a different drapery upon it?—I think a provision ought to be made to meet that.

611. With regard to designs in jewellery, does the observation you made as to the additional costliness of articles of silver extend also to jewellery?—It does.

612. Then in England our designs in jewellery are as good at least as the French designs?—They are superior.

613. Is that in consequence of the better price paid to the artist by the manufacturer?—I am not prepared to say that generally, for the manufacturer is frequently his own designer.

614. Then to what do you attribute the superiority of the English in designs of jewellery?—To the superior encouragement afforded in England to the manufacture of expensive articles in gold jewellery.

615. Does it apply as much to the design as to the execution of the articles?—It applies equally to both.

616. Then both the design and execution are superior in England?—Yes, in articles of gold jewellery, but in imitative jewellery they excel us, for there is greater encouragement in France for the inferior classes of ornaments than there is for the real.

617. In the inferior classes of French jewellery, are the designs better than in the inferior classes of English jewellery?—They are.

618. Therefore in this instance, as in the case of silver before mentioned, the arts extend lower down in society in France, and meet a lower class of consumers than they do in England?—Yes; the propriety of the distinction that I draw between the qualities of the real and imitative jewellery of the two countries may be inferred from the circumstance, that immense quantities of gilt jewellery are annually imported from France, and but little or none in gold.

Lunæ, 10^o die Augusti, 1835.

WILLIAM EWART, ESQUIRE, IN THE CHAIR.

Mr. Charles Harriott Smith, called in; and Examined.

Mr. C. H. Smith.

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619. WHAT is your profession?—Sculptor of architectural ornaments.

620. Have you been long conversant with that branch of art?—I have been in it all my lifetime, and my father was in the same line.

621. When you say sculptor of ornamental architecture, you mean the interior decoration of houses?—More particularly the exterior in stone, and the interior in marble.

622. Describe it as accurately as you can?—Particularly such work as that about the exterior of the new National Gallery, on which I am now occupied; it is that particular department which I principally profess.

623. Do you mean the outside columns?—The capitals and other ornaments.

624. Architectural sculpture?—Yes.

625. Then in regard to the interior of houses, what do you do?—In a similar way; only that is generally in marble.

626. Cornices of rooms?—No, my business is more decidedly in stone and marble; small monuments for churches, ornamented chimney-pieces, &c.

627. Do you find difficulty in procuring useful assistants in your part of the profession?—No.

628. Statuary forms part of your business in churches?—Not figures or imagery, but monuments and ornaments connected with them.

629. Do you find any difficulty in procuring useful assistants?—No great difficulty, (of course there is a choice) provided I can afford to give them a fair remuneration.

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630. What are the ordinary wages of a clever person necessary for your assistance?—According to their abilities, about 2*l.* or 3*l.* per week.

631. You design yourself?—Yes, but I work a great deal under the direction of architects from their designs.

632. Are there any schools or studios where students can obtain instruction, or practise ornamental drawing?—No national schools; a few private academies.

633. The work of the operative is purely mechanical?—To a great extent.

634. But would it be desirable that they should be instructed?—Certainly.

635. It depends very much on dexterity of hand?—A great deal decidedly does.

636. How far do you think instruction is necessary to such artizans?—I have always found those who can draw, if ever so little, are more useful and have the preference. I was going to mention a case in point that recently occurred to me; I sent my foreman into Yorkshire with work; on his arrival he found difficulties arose which he had not, nor had I anticipated, and by letter to me, illustrated by his sketches, he explained all that I could wish for. No one but a man conversant with drawings could have done that; similar circumstances are likely to occur to any man in business.

637. And such men obtain in consequence higher wages?—Yes.

638. You think it very desirable they should obtain the means of instruction?—I think so.

639. What schools or studios are there for mechanics to obtain that instruction and practice in ornamental drawing?—There are a number of private seminaries for drawing and modelling ornaments, and such as is established at the Mechanics' Institute.

640. Are those schools tolerably furnished with the means of instruction for that particular object?—No, very insufficiently.

641. How is the Mechanics' Institute furnished?—I am not so well acquainted with it as to say if it is sufficiently.

642. Do you think it desirable, to give it a more national character, that there should be instruction in those branches of the arts?—Certainly.

643. Do you concur in the opinion of the other witnesses that public exhibitions would be very important auxiliaries?—I have always considered them the best plan that could readily be put in practice for diffusing taste; I have found often among workmen a desire of going to those exhibitions.

644. Among the workmen you employ do you trace any improvement?—Yes.

645. To what do you attribute that?—To good practice and emulation among themselves.

646. Do you include in that the opportunity of seeing works of art?—Yes, the opportunity of seeing works of art, and the opportunity of practising upon works that are likely to improve them.

647. Does the public demand for architectural ornaments increase?—I think it does, especially in my department.

648. Do you think you observe an improved taste in the public, as well as an improved capability on the part of the operative?—Yes, I think so.

649. In what branch of architectural ornaments are we most deficient in exactness?—We are most deficient in the true spirit of the Gothic or old English style of carving; but what is strictly called architectural ornaments are more particularly a mechanical process, such as Corinthian and other capitals, friezes of regular proportional parts, &c.; but where trophies, draperies and those sorts of things occur they become more decidedly connected with the fine arts.

650. Are the workmen less skilful in that branch than the mere execution of the mechanical part, such as the capitals of Corinthian columns?—Certainly, it approaches nearer to a work of fine art, and hence becomes more difficult to execute.

651. You find the want, in those instances you have mentioned, the effect of want of instruction?—Yes, certainly.

652. Do wages increase pretty much in the proportion in which the operative is removed from mechanical labour towards the production of art?—Decidedly, those branches that are purely mechanical and depend much on accuracy of measurement, such as the execution of Corinthian capitals, are done by ingenious

ingenious common workmen, if I may so term them; when they are employed on work nearly approaching to fine art, which requires more study and mental comprehension, of course the men have better practice, and if they succeed they demand higher wages, and are entitled to it.

653. Are the habits of the workmen in your branch of the art improved of late years, do you think?—Materially, decidedly.

654-5. To what do you attribute that?—I think much may be attributed to the change that has taken place of late years, by dividing those workmen who are fond of malt and spirituous liquors, from those who attend the coffee-houses and coffee-shops; the establishment of those shops seems to have separated the two classes, which has, in my establishment the effect, that the men who attend the coffee-shops seem to consider themselves belonging to a more respected class of society, and will not associate with those who go to public-houses.

656. Have you observed among workmen further removed from the mechanical departments, a greater disposition to read than those engaged in inferior work?—Decidedly.

657. Do you think the cheap penny publications have had any effect on their habits, and have been in any way instrumental in improving their minds?—I do think so; most of my men take them in.

658. Do not you think, that simply in consequence of the improved habits of artizans in your branch of art, it is desirable to give them further means of improvement, since their tendency is to a greater degree of refinement, and that they deserve encouragement by instruction, and opening public places of resort, where they will be made familiar with works of art?—Decidedly; I have heard them express a wish to that effect.

659. Both for instruction and the opportunity of inspection of works of art in the national Museum?—Yes.

660. Do you think if they were freely opened they would frequent them?—I think they would, and it would have a beneficial effect.

661. You think more would frequent them?—Yes.

662. Have you heard stated by your own workmen any impediments in the way of seeing works of art?—I have frequently heard them complain of that; and that the museums and exhibitions are not opened after their working hours, and that they have no opportunity of going to them, without not only having to pay for admission, but to lose their time, and of course it thus costs them much more than it does persons in easier circumstances.

663. Then do not you think it is of very great importance that those collections of works of art, whose influence upon the labouring population you think would be so beneficial, should be accessible to them at times when they could be visited without any great pecuniary sacrifice on their part?—I think it would be desirable; I have always considered that the best means of serving the industrious classes, is to increase their means of serving themselves.

664. Have you ever had occasion or opportunity of considering the state of the French nation as to ornamental designs?—I have visited most of the museums in France.

665. Do you think the French superior or inferior?—I do not think them superior in designing. The French are more aware of the importance of employing artists to design for their manufactures than the English are.

666. You do not consider them superior?—No.

667. May not that be attributed to the greater opulence of England, that there is a greater demand in England for architectural ornament?—No; I think that is not the case. What I have observed as to the comparative merits of the same description of works in the two countries, is this; I think ornaments are as well designed in England as in any country, but the French workmen, collectively, are better educated in art than the English workmen; consequently the French artist has a greater facility of getting his designs well executed than the English artist. The French people, as a body, seem not to be so satisfied with inferior performances as the English are.

668. You think there is more taste disseminated in that nation?—Yes.

669. Do you attribute this dissatisfaction with inferior art to any cause, to the education of the manufacturing people?—I think it is owing to the manufacturers themselves not being so well informed in those matters in this country as in France.

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670. Do you think the proprietors or conductors of manufactories in general sufficiently educated in the arts?—Whatever deficiency of taste is displayed in our manufactures, arises not so much from want of taste in artists to design and in our workmen to execute, as it does from want of study and education in the arts among proprietors and conductors of establishments wherein classical design and execution forms an important feature. I am also of opinion, that the public, as a body, are not yet sufficiently educated in the arts to discriminate between pure classical elegance and meretricious finery. I am alluding to the public as a body in this country; and the dealers' study is not so much to improve the taste of the public, as to discover what goods will sell most readily, and produce them the largest profit.

671. But the taste of the public must infallibly operate upon the seller?—Yes, decidedly.

672. A taste more refined would of course create a production more elevated?—Yes.

673. Therefore you think it not only essential to educate the manufacturing artist, but to a certain extent to educate the public?—Yes; I think the one will come with the other.

674. You would probably consider open exhibitions would be an excellent means of educating the public too?—Yes.

675. Do not you think the style of ecclesiastical architecture and the constant presence of beautifully ornamented churches have had a great effect in forming taste in the Catholic countries of Europe?—It would appear so decidedly.

676. Can you mention any particular instance of our manufacturers giving employment to artists?—Coade & Sealey, the artificial stone manufacturers, formerly employed some of our most eminent sculptors; among others, the elder Bacon, and Rossi; Rundle & Bridge, the silversmiths, used to employ Flaxman, Stothard, Theed and Baily, all of whom were eminent in the arts, to design and model for them. Wedgewood used to employ artists of eminence also. At the time they employed these artists they were doing an amazing portion of business. From what cause I do not say, but most of those establishments have changed their system of employing artists of eminence, and they have since employed inferior artists, of course at a much less expense. Whether that is the cause or not, I cannot undertake to say, but their business has certainly fallen off very much; they have now comparatively little or no business of any kind wherein the highest class of artists had been engaged, and the plan appeared to produce the most beneficial results to the proprietors.

677. Are works of art sufficiently protected by copyright, or would you suggest any improvement in the law on that subject, or the application of the law?—They are not sufficiently protected, especially those departments of art which are more immediately connected with our manufactures; I mean that which I profess. There is a constant piracy going on, and in my own practice I may allude to it more particularly. It is impossible to protect myself sufficiently from it. Any original drawings or models, whenever I am out of the way, are liable, by workmen or others, to be pirated, and I have no remedy beyond that of discharging an otherwise valuable workman.

678. Are you protected by any law at present?—Not that I am aware of.

679. You do not of course come under that law referred to at the last examination?—It never has been tried in court; I doubt if it might not come under that head, if it were tried; the copyright of the sculptor; the 38th and 54th of George the Third is understood in general not to include ornamental works of architecture.

680. Does the term "invention in sculpture" occur in the Act?—It does; and if a case were to be tried, it would very likely take in all classes of sculpture; but the chance of recovering is too doubtful and expensive.

681. It never has been tried?—I believe not.

682. You have not turned your mind sufficiently to the registration of inventions?—No, I think some plan of that sort is wanted, but I have not turned my mind to it.

George Foggo, Esq. Historical Painter, called in; and Examined.

George Foggo, Esq.

683. HAVE you turned your attention to the application of art to bronze and silver?—I have been repeatedly employed to design for them.

684. What

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684. What is the state of that manufacture now in England?—Exceedingly depressed.

685. Can you tell us why?—Principally, I should suppose, in consequence of the want of copyright, on which account the French have very greatly surpassed us.

686. What advantage have the French in the protection of copyright?—In England at the present moment the uncertainty of recovering in cases of a piracy, and the great expense attending a lawsuit, make it almost impossible for any but men of great capital to undertake such works at all. When they are undertaken, as the sale is exceedingly limited, those articles are almost universally converted into silver. In France, in consequence of the cheaper law and the greater facility of recovery, a much greater proportion of works of that nature are cast in bronze. So doubtful is the recovery and so great the expense attending it, that where otherwise 50 guineas would be expended on a design, not more than 5*l.* would now be ventured by the silversmith. As, for instance, in one case where the amount to be expended on a piece of plate was 800*l.*, I received 8 guineas for the design. In other cases, where the finished work would amount to 200 or 300 guineas, the utmost the silversmith could spend upon the design has been less than 5*l.* If the copyright could enable the undertaker of such works to spread them to the amount of 20 or 30 he could then afford ten times more on the design, employing none but the best artists, and rewarding them liberally.

687. The reason he does not extend the design to the number of 20 or 30 is because the design is pirated?—Exactly so.

688. What superior protection has the French artist?—I ascribe it to two points, the better definition of the law, and the cheapness of that law.

689. What is the duration of its protection in point of time in France?—I do not know.

690. You know the fact that he is better protected?—Yes.

691. Have you any further information to give the Committee as to the law of copyright in France, and how it is made available to the protection of works of art?—I still think that the main advantage of the copyright in France depends on the circumstance of the cheap law. I was lately in court in a case where the sale of spurious works was most clearly proved. The expenses, I was informed, amounted to 100*l.* and the award for the sale of five different and distinct prints was 15*l.* From what I recollect of such cases in Paris, I should say that the expense would have been under 15*l.*, and the award might have been 100*l.* It is therefore in France worth while (particularly when we consider the certainty of recovery) for a man of talent to claim his protection. It would not be so in London; bronze and silver are the same kind of manufacture, I should say: in most instances bronze is first cast for the sake of the silver plate; that was the case with the celebrated Achilles' shield, by Flaxman. The original shield in bronze, most elaborately and beautifully finished, could not have been sold for much less, if any thing less, than the silver-gilt. But the taste is so much in favour of the more costly metal, that no one would give 3,000 guineas for the bronze, when they could get the silver-gilt for 4,000 guineas, although the value of the silver be not above 250*l.*

692. Was not the article more valuable in one than the other?—I should say decidedly the bronze was most valuable, and I apprehend the taste of the public in that respect is deficient, inasmuch as gold and silver, having what I should term a positive colour, are less applicable to the works of art than bronze, and still more particularly marble.

693. But there is this distinction between silver and bronze, that bronze is more a work of casting?—In fine works it is afterwards wrought up with great nicety by the chiseller; in the above case Mr. Pitts, a very celebrated artist, was employed for that purpose.

694 *a.* Have you turned your attention to the mode of protecting inventions and designs in bronze?—I have.

694 *b.* Would you briefly mention such results of your observation and experience as you think worth describing?—I think, if it were worth the while of a man of talent to claim his protection, it would be best carried out, according to our habits, by special juries. Under the present system this is much too expensive.

695. Would you not propose that the jury to whom it was referred should determine, first, whether the person should have protection, and afterwards

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determine the length of the protection?—I was only supposing a special jury in the case of a trial.

696 *a*. What did you mean by a special jury; did you mean a jury of artists?—I would rather say a board of persons conversant with art, but subject like our juries to a challenge.

696 *b*. Something like a *cour de prud' hommes*, or a board of competent arbitration?—I think so, but doubt whether it would be right for them all to be artists. I also think that the period of the duration of copyright should be in proportion to the talent displayed and the importance of the object. Some cases might not deserve three months' protection, others would require 50 years. Some things deserve also to be better protected than others, in consequence of the great facility of copying them. All works that can be cast in plaster particularly require protection; for that which has cost the labour of months or years and vast expense, may be re-produced by the plagiarist in a few hours. Such circumstances prevent the application of first-rate talent to any such productions.

697. You make the measure of protection depend on the talent of the artist?—In a great measure.

698. Should you not also consider that it would be for the interest of the public, for instance in a very beautiful work, that such a board or special jury as you have mentioned should have the power of proposing, on the part of the public, to the artist, that his design should be bought up?—I should have no objection to that, but I have a very strong objection to the consideration of the interest of the public being paramount. The circumstance of the Americans giving to their citizens an exclusive privilege of copyright, takes away all energy and exertion from those citizens. It has become scarcely worth while for an American to produce a work of talent, when the bookseller can get them from abroad for the price of a single copy.

699. Can you assign any other reason for the French superiority in designs in bronzes; do you think they are superior in the designs in silver?—I am of opinion the French are superior to us in the accuracy of execution of their work, but not equal in fancy and imagination; I have myself been employed to design for a work that has been sent over to France to be executed, and the execution was exceedingly correct.

700. You think the French understand the rules of drawing better than we do; their taste and their knowledge are more correct?—I should speak rather in favour of their execution and knowledge than their taste; for works in metal we still prefer that of the early period of Louis XIV. as more free and effective.

701. Was there some regard to cost when those things were sent to be executed?—I believe it was matter of consideration, but I must say that the execution was exceedingly correct.

702. Superior to what it would be in England?—By the same class of operatives: you might get three persons in this country to do better; but on the average you would find 10 in Paris to one in London.

703. To what do you attribute the superiority of the French in correctness of drawing?—To the various schools of design established in every principal town, but more particularly in Paris.

704. As to the schools in Paris, they are much superior to others?—The schools in Paris are so various, that I do not think that any but a resident in Paris can fully understand the difference; they consist of the Royal Academy and the government school of drawing; of private schools under an eminent artist, and of subscription academies, with no other than mutual instruction. Having resided 17 years in that capital, and studied in one of their best schools and at the Royal Academy for eight or nine years, I am decidedly of opinion that private schools, under the most eminent masters, are greatly superior to any public establishments. The private schools are the original system of the instruction in France, as they were in Italy during its greatness.

705. Are you speaking of the schools of the higher branches of art, or merely for the instruction of artizans?—These schools are generally intended for the higher branches of art; but persons who do not evince talent of a high order, naturally fall into the employment of manufacturers.

706. But are there not schools especially for the instruction of manufacturers, of artizans intended to be employed by the manufacturers of France?—There is one

707. Is

707. Is there only one in all France?—One for Paris; each department has something like a school of that kind; I am afraid it will be found they produce very little of that which may really be called talent.

708. Then in fact the French have no superior system of instruction to ourselves?—There is a national course of instruction very superior to the usual means in England; I mean those private schools.

709. This is national instruction and private schools?—It bears the most national character of any.

710. Explain it?—Every man of talent, as an artist in France, is supposed to owe much of his reputation to the pupils he produces; his object is to produce men of superior abilities, but the school gets popular and the system is so well understood, that the number of students becomes very great, and from their superiority they are, when interest does not interfere, appointed teachers in the government schools, and give a general tone to the talent of the country as far as circumstances admit.

711. Then the government schools, you say, are of no use?—They are very inferior to the others in utility.

712. How can those be called national schools if they are only private establishments?—They are not government schools, but they have the spirit of the country in them much more than the government schools, for the government schools are founded on one system, and, with one or two exceptions, all follow the same course; they do not fall into the wants of the times and the people so much as the private establishments.

713. How do you make out that those private establishments are national schools; if they are private establishments, they can hardly be called national schools?—I hope I have not made use of the term so as to bring it under the common English expression of national schools; I do not mean that they are in name national schools, but they are the schools that give a national character to the French artists; which character is materially checked by the control of Government administration.

714. Then there is no use in national schools in France?—In France Government interference in positive instruction is injurious.

715. Where is the encouragement given to art in France?—It is principally from the liberality of exhibitions, and most particularly of the libraries and the museums. The opportunities of study in the libraries and museums are far superior to any thing in this country. I may mention in proof thereof that the works of Flaxman, of Mr. Hope, and the publications on Etruscan vases of Sir William Hamilton were shut up in private collections in England, and produced little effect on the public taste; but being placed in the libraries in Paris and other towns, where not only artists but the public had free access, the knowledge and taste of Flaxman and Hope became there generally appreciated, instead of being, as in England, confined to a few. A fine example of their museums was that of the French monuments, where, in appropriate halls, samples of French statuary of seven successive centuries, afforded an excellent opportunity of studying the taste and the history of the nation. That of mechanical machines is also of great utility.

716. Then would you advise that there should be no instruction given to the manufacturing artist to that person who is to furnish designs for manufacturers, whether in tissues or metals, further than opening exhibitions in our towns generally?—Museums, I apprehend, must be the permanent and all-important sources of taste. Public lectures on the great principles of design and taste may be advantageously added thereto; and from the necessity of the case, another country being so greatly in advance of us in those branches, schools for the instruction of mere outline, and still more of the rules of perspective, would produce very great and beneficial effects.

717. Then you do think so much may be taught in schools, as regards what may be termed the positive and true in art, perspective, anatomy and those things, which, not concerning taste and imagination, are founded on unchangeable principles?—I certainly do think that much advantage would be derived from instruction in the proper simple rules, without shackling the taste; but it appears to me that good taste is so essential to the interests of the community, that museums should be provided at the national expense; but practical skill being an advantage of a more individual nature, ought rather to be paid for (moderately) by the individual.

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718. Is the public taste highest in England or France?—The general taste is decidedly highest in France.

719. You have also mentioned you consider superior taste and imagination more frequent in England?—I do.

720-1. How do you account for the distinction?—I think the arrangements of Louis the Fourteenth and Colbert have placed such fetters on imagination that the utmost that instruction can do in France is to inculcate fixed principles and precision of execution.

722-3. Was there not a very material change under Napoleon; did he not throw open the public taste more than what you have stated?—In the fourth year of the republic, under the Convention, schools of various kinds were instituted. Exhibitions and prizes were also decreed on a liberal scale, but they were ultimately counteracted by the re-establishment of the Academy, similar to Louis the Fourteenth's, and the occasional injudicious interference of the emperor. There has been no alteration in the academy of arts from 1800 till the present moment, except the exclusion of foreigners from the prizes, and a few minor bye-laws.

724. Do not you conceive that the fixed principles and correctness of execution are all that can be properly conveyed of instruction to an artist?—They are all that can be wished for when competition is encouraged.

725. And without free competition art is stifled, therefore it is essential?—Yes, absolutely essential. With regard to the departmental schools, if the appointments of professors were popular they might do a deal of good; but when I have seen an old man of 62 or 63 appointed to one of those schools, not for the good of his pupils, but to save him from starving, I cannot expect much good therefrom; when I have known in the principal school for the mechanics of Paris, a man of the highest talent, M. Peyron, after 25 or 30 years' exertions in the under professorship, superseded in his claim to the higher professorship by a friend of the minister, I find a total want of that principle, which free competition and proper elections would have carried out.

726. The reason you think superior taste and imagination more in England, is on account of the restriction in France?—Yes, being under the minister of the interior, all follow one system and routine. In England, competition is created by commerce, which frequently brings a man from the humbler branches of manufacture to the highest stage of art, such as Martin, Muss, Bone, Bacon and Banks.

727. In fact the French attempt to teach that which is probably not within the strict limits of teaching, and interfere a great deal too much?—A great deal too much.

728. But still you admit the propriety of teaching the positive, the undeniable, fixed and positive rules of art, such, for instance, as perspective, anatomy, proportion and perhaps botany, and those things which connect arts with manufactures, in which the principles are undeniable?—I think it almost as necessary for a people to possess a knowledge of those points as to know how to write; I consider it a second way of reading all the beauties and merits of nature.

729. State the deficiencies both in England and France which exist?—First, the deficiency of correctness of perspective, even where correctness of outline is otherwise generally attained; perspective is often little understood in other countries, but is particularly neglected in England. Secondly, a very imperfect knowledge of the history of the arts and of commerce, their effects on each other and on the state of nations, and thence false theories.

730. What is the relative influence of the taste of Paris and London?—That the taste of Paris spreads all over France almost like lightning, while that of London is very much counteracted by the different habits and influences of our commercial towns; for this very reason, museums exactly similar might be established in France without any material injury; but museums in England would be best under the direction of a general board, but modified by the management of men capable of applying them to local purposes. If the town of Liverpool had a museum, it certainly would not, if left to the management of a local board, be similar to a museum in Birmingham or Sheffield, and it would be right that they should not be similar. A knowledge of mineralogy might be exceedingly useful in one town, and perfectly useless in another. Objects of general utility, of general taste, such as fine representations of the most beautiful pieces of sculpture; objects of taste, such as vases and ornamental designs in general, might

might be exceedingly useful in them all, but each would superadd what was of local interest, in proportion to its connexion with different countries, and the manufactures on which it depended.

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731. Would you combine any thing like a central system with a local system, particularly adapted to the character of the place, where the different institutions were established?—I think it most important that a local administration should be under a general control, or the control of a general board, in order to prevent local interests from holding too great an influence in the elections, and contracted views in the management; for I am greatly mistaken, if under a well-controlled representative system, the arts are not capable of disseminating knowledge in fifty ways that have never yet been attempted, and I am also strongly impressed with the notion that they should tend to a general improvement of the morals of the people as well as of their intellect. I have no doubt that under a proper general board with local management they would be highly capable of both.

Some of our manufactures far excel others in the merit of the designs, and this is usually in proportion to the difficulty of copying them, as the injury of a deficient copyright is therein less felt. I should instance, particularly, the japan manufacture, where the designs are more exquisite than anything produced abroad.

732. Do you attribute the excellence of design to the difficulty of copying?—Partly to that, inasmuch as it is an impediment to the plagiarist, and consequently a protection to the original designer.

733. You give the japan manufacture as an instance of that?—In consequence of the difficulty of the manual operation itself, the thing is better protected, and I ascribe it partly to the system of encouragement and competition established in the manufactures themselves; the works in japan are, however, conspicuously defective in perspective.

734. Do you mention this as an instance of the necessity of giving greater correctness of design to our manufacturing artists?—To show that of all the branches that ought to be taught, that of perspective is one of the first, inasmuch as it is not readily to be obtained.

735. Are there persons now employed in forming designs in japan as a business?—No, not mere designs; each manufacturer has his own designers and painters.

736. Is designing now a trade by which certain individuals get their livelihood, that is, to furnish patterns to the manufacturers of designs in paint?—I believe not, at least in Birmingham; what there may be in London I am not acquainted with.

737. You consider there is a deficiency in the production of designs from the circumstance of sufficient encouragement not being given to the instruction of persons in designing?—I consider in that particular line the designs are very superior, but there are inaccuracies from want of instruction.

738. Have you ever had an opportunity of comparing the japan of this country with the French?—At some interval of time and distance I examined them repeatedly, but not lately; there are no French ones that can at all compare with ours.

739. Which have the superiority?—Ours as far as possible; the French would shun the competition, though many individuals in France are anxious to introduce our japan articles into France at present.

740. Do you consider the japan better, or is it for the sake of the design?—I consider we have the advantage in both ways; we are not equal in execution to the Asiatics, but superior in design.

741. Have you had an opportunity of knowing the mechanics' institutions?—I have.

742. Would you consider the mechanics institutions the best medium through which to establish this mode of instruction, with a better code of laws, if their political feelings would permit?—Political and religious discussions are generally excluded by the laws of mechanics' institutes; but there is a strong aversion in the leading institutions to the Government having any thing to do with them.

743. Our friendly societies are regulated by an Act of Parliament; if some Act of Parliament regulated the mechanics' institutions, giving them correspondence with one in London, and an interchange of models and designs,

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would that be a very good course?—I am afraid sufficient attention has not been paid to the history of our benefit societies. I have not a doubt if those societies had existed without the late poor laws in England, they would have been so alike, so perfect in their management, and so generally in use, that you could at once apply any thing by their means.

744. These mechanics' institutions would be so far more beneficial than any school of design, that they would convey to pupils knowledge in chemistry or mechanics or design, according to their natural genius; would that be better than restricting a school to one pursuit?—They would do exceedingly well if you could manage the election of the professors; but in that case a member of an institution is more likely to be elected than one not a member; it is therefore local talent which gets the influence, which is not so good as a person confirmed by the approbation of a general board.

745. The professors of those institutions might be subjected to the decision of a board in London, might they not?—If the institutions would agree to that, much good might be effected.

746. The advantage mechanics' institutions would derive from the parent institution is, they would collect a variety of models, which they cannot now obtain?—Certainly.

747. Therefore in this country where you have three or four branches of trade carried on, in Manchester, and in some places almost every branch of trade, you would not confine it to a school of design only, but make it one branch of what would be a drawing class; those who have a taste for chemistry would be good preparers for the materials of printing, and so you would make it useful?—Yes. Another way might also be easily accomplished, by placing museums under the direction of men capable of communicating instruction.

Samuel Wiley, called in; and Examined.

Samuel Wiley.

748. WHAT firm do you belong to?—Jennings & Betteridge, of Birmingham.

749. Do you pursue the japanning trade?—Yes.

750. Have there been great improvements in that trade of late years?—Yes.

751. To what do you attribute it?—To the energies of Jennings & Betteridge; being men of taste, and stimulating their apprentices and teaching them the art of drawing; they have taken great pains.

752. You attribute the extension of their manufacture to that instruction?—Yes.

753. Do you think further instruction is requisite?—I do; I think it is essential to form part of the education; the art of drawing, whether they are to be japanners or any other art or trade, it is, I think, a great assistant.

754. In what particular branches of execution do you think they are deficient now?—In perspective.

755. In any other besides?—Generally in outline.

756. Do you know whether the workmen themselves, if they could obtain public instruction, would feel it a benefit to their manufacturers and themselves?—I believe they would prize it much.

757. Are the habits of such men now such as would induce you to suppose they would more highly value this instruction than many years ago?—I think they would.

758. Their habits are improved?—Yes.

759. Have you had an opportunity of seeing that, so as to say if the exhibition of the works of art would be of use?—I think it would.

760. They would attend?—Yes.

761. And take an interest in them?—Yes.

762. Have you heard them express an opinion of that kind?—Yes, frequently; our men have inserted works of art in the Birmingham Exhibition and other places.

763. Some of your artizans have contributed to exhibitions?—Yes.

764. Are there any other deficiencies which you would wish to notice in the present works of the japanners in which they want instruction?—No, I think that embraces all that is essential.

765. Can you make any other suggestion which would increase your trade and encourage artists?—By improving the public taste; the public taste is bad; I could

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I could sell them the worst things, the most unmeaning, in preference to the most splendid designs and the best executions.

766. To what do you attribute this defect in the public taste, and how would you remedy it?—I do not know by any other means than by the rising youth being taught the art of drawing and perspective.

767. Do you mean the rising youth in our manufacturing towns?—Yes.

768. Those who devote themselves to manufacturers?—Yes; and public exhibitions would lead the public to view for themselves, and they would begin to form a taste in those things.

769. Is this the result of your observations in Birmingham?—I could frequently sell bad articles, bad in execution and design, for the same money as I could sell the best.

770. You think that the means you suggest would increase the public taste?—I do not know what else would; it would excite them to a spirit of inquiry.

771. Has the public taste improved?—I think it has.

772. And you think, as better things are submitted to them, the public taste will be improved?—Yes; it will gradually supersede those awkward unmeaning designs which they have generally been accommodated with.

773. Do you imitate the Chinese patterns?—No.

774. Do they imitate ours?—No, they adhere to but one style of work exclusively, and that most beautiful in point of execution, but unmeaning as it regards design and perspective; in fact, the designs are very bad.

775. Is there any information you wish to give respecting the Chinese?—The materials they use I consider one great means of their goods looking so much better than ours; the material they use. Their material after it is laid on, whether it is gold or gold powder, is never varnished, and there is a degree of brilliancy and richness that never appears after it is varnished; we are obliged to varnish ours to preserve its colours, in doing which we lose a great part of its brilliancy. Some years ago we procured gold powder from China, and could make it appear of the same appearance as that from Canton, and we found it very valuable indeed for the purpose of imitating the Indian cabinets and the various articles we have to copy or to repair; but there is a different appearance, as different as possibly can be, between the Indian gold and gold powder, and that of British manufacture; and the material they use for laying on the gold is different; we are informed it is a gum extracted from trees, and when the parts are laid on they are the very same as though you cut small gold wires and laid them in, there is that prominence.

776. It is more in relief?—Yes.

777. There is no impediment in procuring gold powder?—There is no trade in it; we only got it from one person.

778. You could get it by sending to China?—It was accidentally we met with a party who had been an Indian merchant.

779. Is it so dear?—No, we found it much cheaper than ours; Mr. Jennings was about making a journey to Canton to procure some himself.

780. Is it generally used, that gold powder?—No, we cannot procure it.

781. The Chinese prohibit the exportation of it from China, do they not?—I believe so.

782. Or is the importation prohibited here?—I do not know; we have applied to various merchants for it; whether it is an article that never comes under their observation we do not know.

783. Have you had it analysed?—No.

784. Could you not try the quality of it by taking some off a piece of workmanship in their trade?—No; we have endeavoured to procure more.

785. Did you not analyse it then?—No.

786. You are not aware whether the difference arose from a combination of gold with other metals?—I think it is prepared by a chemical process, and I think also that it is from the compound that it is better; very likely the metal with which they mix their gold is of a finer quality than ours.

787. The Chinese have a great advantage in their gums?—Yes.

788. Has the Japan trade very much extended of late years?—It has.

789. Have our exports of Japan articles increased?—Generally gums, except to France, and there we send the best we make.

790. Do you send much to the United States?—It is generally very common.

791. To

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791. To what countries have they increased lately?—Principally for home consumption.

792. Do you pay the persons who paint the articles by the piece generally?—Yes, and some of them, the best of them, by the week.

793. How much do they earn by the week?—We pay from 15s. to two guineas; in some few exceptions we pay from three to four guineas and a half; one we pay four guineas and a half; the only one.

794. Are persons in your trade employed exclusively in drawing patterns?—No, some excel more in designing than others, the working men; every workman designs his own pattern.

795. Is a good designer well encouraged?—He is the most valuable man.

796. By the manufacturer?—Yes, he is the most valuable man he has.

797. Is there any want of talent among designers, provided it were sufficiently developed?—There is a want not of talent but of facilities; good things to copy.

798. State why you think the French prefer our articles?—They are much better.

799. It is the quality of the material, not the workmanship?—Both material and workmanship are better.

800. And the design too?—Yes.

801. Your designs are superior?—Yes, superior to the French in the japan trade, in characters and the beauty, and every thing.

802. You state we are defective in outline and perspective; have the French the same defects?—They do not seem to raise the japan trade to an art; they appear merely to daub it over and call it japan; there is neither design nor beauty of execution.

803. Is it necessary for a person who designs, to be acquainted with the manufacturing branch of the business?—Yes, it is indispensable.

804. Would it not be necessary the artist should be instructed on the spot?—No, I think not.

805. If it be necessary to combine the designing and manufacturing, it would be necessary to have a school to teach them on the spot, would it not?—No, we generally come at 12 or 14 years of age; if they have previously been taught drawing with perspective, it is a sort of tuition in the other branches; drawing and perspective are essential for them to be taught this afterwards.

806. You teach them first of all drawing and designing, and then manufacturing?—Yes.

807. You think the first branch may be learned in London or elsewhere, and the rest in Birmingham?—Yes.

Veneris, 14^o die Augusti, 1835.

WILLIAM EWART, ESQUIRE, IN THE CHAIR.

M. Claude Guillotte, called in; and Examined.

M. C. Guillotte.

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808. YOU are a maker of jacquard looms?—I am a maker of jacquard looms, and of all sorts of looms for silk manufacture, and of French bar looms, by Premaillerre, upon which (the bar looms) from ten to thirty ribands at a time may be manufactured, and the whole of the machinery conducted by a young man. Of those, I manufactured 150, at several times, and for several parties; and they were the very first ever introduced to this country, and for which machinery I took out a patent.

809. Do you make them for cotton?—No, I make none.

810. Does not jacquard machinery adapt itself to all sorts of tissue?—Yes, I made three years ago the most complicated machines ever produced in England, with 4,600 threads, at a cost of 50*l.*, and before it was put in order and set to use, it cost 100*l.*; it was for weaving napkins and table-cloths, which was all worked by one man. I also made many of the jacquard machines, with 1,600 to 1,700 threads, for smaller table linen. Of late, I am making jacquard machines by hundreds,

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dreds, for all parts of England, where it had not been introduced before. For Yorkshire, I am particularly engaged at present making them for merinos and damasks, and the same for Bolton and Manchester; I have agents in Manchester, and Bolton district; and I have been engaged in making them at Coventry for riband.

811. Can you give the Committee any information as to the number of jacquard machines in operation in this country?—From 7,000 to 8,000 jacquard looms.

812. Has there been of late any great augmentation of the demand?—There has been an extraordinary increase; for the silk manufacture, I received in London orders for 6, 8, 10, at a time; in Yorkshire, I receive orders for from 60 to 80 at a time; and for worsted manufactures, the demand is also considerable. The demand commenced about 11 years ago, and has become much more active of late in Yorkshire; and yet, I was four years ago in Yorkshire, at Halifax, Huddersfield, and the surrounding country, with an interpreter, taking with me half a dozen, and there was no individual willing to purchase one; and after my return, I received an order for one machine, in order to make an experiment; it succeeded, and the consequence was, an order from the same individual, a Mr. Gill, to manufacture more than a 100 such machines, and there was a demand at any price from every body. These were to replace the old mechanism, which was employed in producing small patterns; those are principally used for waistcoats.

813. Does the demand increase?—The demand could not continue so great as it was; it was very great. There is still a demand, but principally for merinos and damasks. In Scotland I have an agent, but I do not do much, the price of the cards for the manufacture of Scotch shawls being too high. The difficulty of applying these cards to shawl-making is, that for the production of the beautiful pattern, 5,000 or 6,000 are required, which makes it too expensive a machinery. At Norwich, a good many were sold one or two years ago, but they are expensive, and it has prevented its being much applied to the silk manufacture. In Scotland, they use a draw-boy instead of a jacquard to make the figure, to draw the threads that produce the figure on the cloth; in Scotland and Norwich, the number of cards which are necessary for the production of a figure make the employment of jacquard machines much more expensive.

814. What are the average wages they obtain in the manufacture of your machines in London?—Sometimes I employ foreign workmen, but they leave me when they can better their condition; and a good workman, such as I can employ, will get thirty shillings a week.

815. Is the price greater in England or in France?—I think the price is cheaper here than it is in France, and I account for it thus: Because I carry on the whole of the manufacture in my own workshops; while in France the production of a jacquard machine is divided among the workshops of several persons.

816. Is there the same competition in England as in France?—There are only two principal makers here, but the competition between those two is so great that the prices are kept low.

817. Some have failed who make them?—Many inexperienced persons have made attempts, but have not been able to compete with those who had more experience, and they have failed in producing the article as cheaply as we. I employ about from thirty-eight to forty workmen, all in London.

818. Is your trade confined to manufacturing machines, or do you give instruction as to the pattern and reading and stamping the cards?—I have a clerk who undertakes this latter department, and in my own house I give instruction on the subject.

819. Will you explain what takes place in the adaptation of the design to the loom?—First, the design or pattern to be made on the cloth is drawn on paper and produced for approbation; it exhibits on paper what it is intended to be on the cloth; as the threads are very minute, they are then as it were extended on another paper, the rule-paper, of a larger size, which shows the pattern as it were magnified, so as to place so many threads to the inch, perhaps 20, so that every square represents a thread. This is what the French call *mise en carte*, and in English put upon rule-paper. The next process the rule-paper undergoes is, to be read in, which transfers the pattern from the rule-paper, and prepares it fully for the stamping of the cards. The rest of the process is mechanical, consisting of punching holes in the cards, according to the number required, and applying the card to the machine. In this mechanical operation I have seen 200 boys employed in weaving the richest figures in the loom. To so simple a principle is the process of weaving now

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reduced, that even boys of 16 are set to weave the figures of so complicated a nature, as formerly would have required men of 20 or 30 years' experience.

820. In this process what is the difference between the French and English manufacture?—In some departments the manufacture is superior in England; in others in France. Plain silks, if manufactured with the same materials, the production will be equal in England as in France; figured silks are equal, as respects the mere manufacture; and there are two points of inferiority, the designing and the *mise en carte*, put in rule-paper.

821. Have you observed any particular reasons for inferiority in England?—One cause which has much struck me is, the very costly price of cards. In the woollen manufacture the cards which have been used for woollen goods have, as I have observed, been returned to the Excise. A return of duty has been obtained. I think that if the same thing were done with the jacquard cards, it would have a tendency to diminish the price. Though generally speaking the price is about equal in the two countries; yet in the reading the designs there is this enormous difference; the average price in France is three francs, or half-a-crown sterling; in England, the price was a long time 15s.; it came down to 10s., and I now charge 8s. per hundred. I attribute that to two causes, the presence of silk-manufacturers, which has created a greater competition and a greater necessity for activity.

822. This activity commenced in 1823?—Yes; but since 1826 the activity and competition were very greatly increased. The consequence of this competition has been also the introduction of a great many French dyers to settle here. The French designer understands the *mise en carte* (putting on rule-paper) better than the English designer; and the French *metteur en carte*, understands design better than the English *metteur en carte*. The great reason that occasions this great difference between the *metteurs en cartes* and designers of England and France is, that the designers themselves are obliged to put it on the rule-paper, and previous to that go through every branch of the business, (including the weaving), and this is undoubtedly the cause that they are more perfect.

823. Do they design better in France than here?—I do not mean to say that; but there is a much greater number of designers of the same capabilities in France than here. In consequence of the encouragement the French designers receive, they are as well more numerous as more talented in their science, in common; although there are individuals in England equally as clever, and with a profound knowledge of their art.

824. Is the designer and the *metteur en carte* the same person?—The artist who draws the designs at Lyons is the artist generally employed to transfer it to the lined paper. This person, whom I consider the *metteur en carte*, is only employed in that; he is inferior here. In Lyons, in a great number of instances, there is never a design drawn at all; but the first production of the design is on the lined paper. The *metteur en carte* is himself an artist. It is in the connexion between the arts and the manufactures that we are inferior. In France a manufacturer employs from three to four artists, and in England one artist supplies eight to ten manufacturers.

825. What is the difference in the wages of an English and a French artist employed in painting the patterns on the ruled paper?—I have long endeavoured to obtain such an artist from France, and I think if I could obtain such a one as I desire, it would answer my purpose. An indifferent artist of this sort may be obtained for 50*l.* a year, but there are men whose services are worth from 400*l.* a year, or even a share of the manufacture. The sale of the fancy trade entirely depends upon the taste and abilities of the designer. In France there are often only one or two artists who are paid, and largely paid, who get from 180*l.* to 200*l.* a year, but there are several who give their services for the instruction they receive. The *metteur en carte* ought to be well instructed in designing. He ought to be also well acquainted with manufactures in theory and in principle. They are so at Lyons, but they are not so in this country.

826. When was the jacquard loom first adopted at Lyons?—After the Revolution. Before the invention of the jacquard machine, eight or ten years were required to make a good workman; afterwards six months were sufficient. For 10 years after the discovery, the machinery remained with very little influence, but designers increased with the introduction of the machine.

827. Was the secret of the jacquard machine long kept in Lyons?—It was kept, and it was not kept; the machine was not originally of great value.

828. At

828. At what time did it come into activity at Lyons?—From 1808 to 1810 the machine was brought into activity, but at that period it was very imperfect. In 1814 it was much improved, and in 1815 it was fairly established.

829. Did not the French manufactures materially improve by the jacquard loom, and gain great advantage by it before other nations?—When France possessed the monopoly of the jacquard machine it gave her great advantage in other countries; but since it has been introduced into many other countries; France has only by great exertions produced better and cheaper than they.

830. Is there a school of design at Lyons?—Yes.

831. In consequence of the discovery of the jacquard, have there been any changes in the school of design at Lyons?—The young artists have since the discovery particularly turned their attention to the *mise en carte*. There has been every augmentation of such young artists; indeed there were no such artists before; for it was found requisite to set up jacquard machines in the school of design. This lasted two or three years only, as they now obtain the required knowledge of the loom out of the school. The discovery of the jacquard loom infinitely multiplied the number of young artists, who devoted themselves to the *mise en carte*. The great advantage of jacquard machinery is this, that it enables that to be done in a few weeks, which before occupied months; and that the change of a pattern formerly was a long, laborious and costly affair, and now it is a very simple one, and may be done in a few minutes after the completion of the reading and the stamping of the cards.

832. What do you consider the best means of instruction for the purposes to which you have been referring?—In France, in ordinary cases, our artists receive six months' instruction in the theory of the manufacture before they are called into the field of practice, after they have been instructed in the school of design at Lyons; or artists, during their instruction, must pass two hours a day to understand the theory of the application of the design relative to the machine.

833. Are there not instructors in Lyons who give private lessons to artists, particularly with respect to the *mise en carte*?—There are private instructors who give those lessons in the school of design at Lyons; they also give instructions in the *mis en carte*, making their talent practical.

834. How many jacquard machines are there in this country?—From 7,000 to 8,000.

835. Are the English in the habit of copying the French designs?—The English copy the good French, and the French copy the good English.

836. What are the best English designs?—The best are those in cotton goods.

837. Can the designers for the cotton trade in England design equally well for the jacquard machine?—They do not understand the *mis en carte*.

838. Where do the English obtain such knowledge, enabling them to make good patterns in cotton?—The English designers, who make these good designs in cotton, are instructed at Manchester, and elsewhere, but the number is not great; for the drawing of silks, Mr. Adams and Mr. Perrin are good, and there are four or five inferior.

839. You sometimes make good copies from English patterns for the Spital-fields looms?—Yes, many from the English printed muslins, but it requires taste and knowledge to arrange them.

840. The French manufacturer can come with patterns every year to England, bringing with him patterns on the material; not only designs on paper, but on the material; whilst the English manufacturer only brings it on the paper?—Yes; the cause of that is, the French manufacturer employs weavers who are solely engaged in the production of patterns, and as the pattern on the tissue cloth shows more distinctly the effect than the drawing on paper, it gives them an advantage in the market.

841. Do you know any one who collects English patterns, takes them to the continent, and brings the continental patterns to England?—There are individuals who are engaged, and who collect at Paris the patterns in vogue there, which they bring and dispose of in England, and they also carry to the continent such patterns as they can collect here for the purpose of sale. These only serve as mere ideas; in the execution of the working drawings the French improve upon us.

842. If there were a school of design established in London, what do you think would be its influence on English manufactures?—My opinion is, its effects in

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three years would be so to equalize the manufactures of the two countries, so that the country in which they were produced would not be recognizable.

843. Is the jacquard machinery applied to other raw materials besides silk?—It is applicable to every thing which is figured or flowered, every thing that can be woven. The jacquard is applicable to every species of tissue to which a loom can be applied, even to straw hats, horse-hair and wire, and every other species of web.

844. What are the principal difficulties in the way of improvement in the silk manufacture?—The first is the high duty on paper. The high price of paper has this injurious effect, that the manufacturer is very unwilling to change his patterns. There is a difference between the cost in France and England; it is as one to four.

845. Is the English card here inferior to the French?—The English is superior, but that makes little difference, because it is never worn out, a new pattern being always introduced before the cards are worn. The two disadvantages I consider are these, the higher price of the cards, and the inferiority of the *metteur en carte*.

846. Do you attribute the difference to the Excise duty on paper in England?—Much of that difference I attribute to those causes. Much of the difference I attribute to the Excise duties; but I consider the great impediment the inferiority of the English artist in the *mise en carte*.

847. Have you an opportunity of knowing whether the English manufacturers recognize their inferiority, and would be willing to do what depended on them for its removal?—I have had frequent opportunities of conversing with them on the subject, and I think, when they see the difference it produces in the work, they would do so after some time.

848. What is the difference as to the dyeing, if your attention has been called to that subject?—I think, in a great many cases, where there is an apparently greater beauty in the French dyes, they are much less permanent than those of England, and I have seen many examples where, after a few weeks' wearing, the French colours have wholly faded.

Gentlemen,

HAVING answered thus to the best of my knowledge your questions, I take the liberty of making the following few remarks about designing and *mise en carte*; for as this is the very head part of all that belongs to the weaving department, and at the same time is the very least cultivated in this country, it is before any thing else the most worthy of your attention and consideration. For as long as this part of the manufactory is not highly improved, and proper schools for design and *mise en carte* erected, and children, who already have acquired the practical and theoretical part of weaving, are engaged and trained up in this art, France will always have to boast over England of the honour of sending more fancy patterns, and finer and more beautiful workmanship, and, in fact, brought to the highest perfection. But, on the contrary, if it should meet with your Honourable Committee's approbation, and get the least encouragement to bring it into fulfilment, and to get such schools erected in some quarter of Spitalfields, or its arrondissement, there is no doubt whatever in a very short time the English manufactures will soon rival, if not altogether equal, the French manufacture, and thus throw off the shame of seeing foreign manufacture surpass the English in quality and superior workmanship.

Your very humble Servant,

Claude Guilloffe.

Luncæ, 17^o die Augusti, 1835.

WILLIAM EWART, ESQUIRE, IN THE CHAIR.

Mr. John Henning, called in; and Examined.

Mr. John Henning.

17 August 1835.

849. HAVE you been in the habit of executing works in relief for a considerable time?—Yes.

850. You executed the frieze on the entrance over the gate-way at Hyde Park Corner, and the frieze on the Athenæum?—Yes, in conjunction with my son John, who had contracted with Mr. Burton to do that work in 1827, which was followed by the frieze of the Athenæum, which was a selection from the sculptures of the Parthenon. On both friezes the design was drawn upon the stone and cut without the usual process of pointing. These were our first works of the kind in stone. Previously I had been engaged principally in drawing and modelling, and our first work

work in intaglio was the sculptures of the Parthenon, which was begun in 1816, and finished in 1822. *Mr. John Henning.*

851. Have you ever had occasion to consider the subject of copyright?—Yes, I have, but I have only to tell the Committee of the difficulties which we modellers and sculptors experience; I do not feel that I dare presume to propose a remedy, though I may notice the evils which I have suffered.

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852. State them as clearly as you can?—I have brought a specimen of the frieze of the Parthenon engraved on slate in intaglio; I have also brought a cast of this intaglio in plaster, and another, broken, in the way in which it appears now in the Museum; the intaglio is the matrix from which these casts have been taken; previous to engraving the intaglios, careful drawings were made from the mutilated marbles, and the deficiencies were made good to see the effect, and then they were transferred to the slate in the opposite direction, that they might be right when cast.

853. You were going to state the difficulties which these specimens were to elucidate?—Yes, as soon as the casts are issued, whoever lays their hands on them may, with very little trouble, take moulds in sulphur, wax or plaster, and multiply them to any number.

854. You consider that the law does not afford you protection?—There is no protection, as I understand, but in an action at law. The thing appeared so unmerciful to me, to lay hold of a poor man to raise an action against him, that I never could think of doing that. It struck me that if there was anything like a committee of art in London that could be appealed to, to identify where a spoliation or theft of this kind had taken place, it might be much cheaper than law.

855. A species of arbitration committee?—Yes, for any gentleman who knew anything about it, could detect those thefts readily.

856. Have you ever thought of the subject of registering such works?—I always have understood by the law, that if you put your name and date it was sufficient, but I think such property as much my own as my clothing, and no one has any more right to appropriate it, than to claim my personal labour without remuneration. The originals exist in the Museum, open to all who may desire to make studies from them, without condition, but compliance with the economical arrangements of that institution. This would be fair and honourable strife, who could do best; but what hand or heart can contend with the covetous and unjust, who, by the cunning labour of a few days can contrive to rob me of years of life, and scatter over the whole land the deteriorated casts of my works, much to my prejudice as an artist?

857. All you want is a cheap tribunal?—That is the very thing wanted.

858. Have you suffered from your own works being infringed upon?—Yes, very much indeed.

859. Can you give any remarkable instance?—I had, within the last six months; a man, without giving me his address, wrote to me twice, and put me to the trouble of writing to him; at last I got a third letter, giving particular orders to make them ready. I took it to be some gentleman; at last I found after I had packed them up by a given day, I found he had gone to a person who was in the habit of furnishing people with them, and he never came near me. Nothing would do in that case but an action at law, therefore I preferred rather putting up with the loss.

860. You submitted silently to the inconvenience rather than encounter another?—I cannot blame anybody for that but myself.

861. Then he pirated your works in this case?—No, I could not call this piracy, but rather resetting, for he went to the pirate who served him with my stolen goods; but many have pirated them, and continue to do so.

862. You felt you could only have recourse to an action at law?—I never understood that I had any other recourse than that.

863. Why had you not?—Because of the expense, and I could not think in my heart of prosecuting a person, probably without a shirt, who perhaps did it from poverty; I could not proceed against him.

864. You are a self-taught artist?—I do not know what to answer to this question; however I have not had any thing like what might be called regular instruction in art. In art, as in every profession, the master, in many cases, can only be considered as the finger-post which points the road the pupil must go on to the place; the pilgrim, creeping or running, must exert himself to the end of his journey, otherwise he will never arrive there.

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865. Do you think instruction in the arts generally, in a national point of view, is advisable for persons acquainted with the manufactures of this country?—I think, in the present state of society, as there are so many means for individuals to be instructed, that I do not see that the interference of the Government would do much good. The one great good that an academy or school with a good museum would be, to give facility to study to the willing, who are often prevented from advancing in their pursuits by the difficulty of access to proper models. I would propose a voluntary subscription museum, conducted by a committee of the subscribers, in places where these were to be found, furnished with models of every description, particularly all mechanism of every department of manufactures, every kind of fabric of cloth, plain and ornamented, or coloured, and if possible the mechanism by which it has been done. A museum of this kind, with proper regulations, under the care of a person or persons qualified to make it useful, under the control of a committee, would be of much use in promoting skill in art and science in design, whether it were the highest branch of art or the more common, where the artizan plans to combine beautiful forms with various colours in fabrics of cloth; in short, in every profession it would be of use that the operator should be able to draw any thing which may occur in his profession; the surgeon, by drawing and modelling, would acquire a more correct notion of the position of the localities of the veins, arteries, &c., of the human body, and so with every art. Drawing and modelling give great power of description. I think society ought not to trouble the Government with things which it can so easily do itself; and done in this way, I think that it would have the best effect; while it would be a proper stimulus for the improvement of talent, it might bring to light the more rare and superior minds, and lead to the existence of a general true taste in the decorative arts. The carpenter would study what related to architecture; the geometrical construction of roofs, centers for bridge-building, &c.: the cabinet-maker would be engaged also in straight-line drawing, construction and the ornamental parts of his art.

866. The question referred to art rather than manufacture?—Every man who follows any profession should have something of drawing relating to his profession; and a workman, such as a jeweller, ought to be a draftsman, for he in fact does not work by the square and the compass, but by the eye; therefore he should be taught drawing.

867. You think the principles of drawing should be united in some way with elementary education?—Yes, with every profession, and the weaver as much as any; most of the weavers of my native place, Paisley, used to draw their own patterns, and many of them could do their own machinery. The drawings in many cases done by themselves were transferred to the cloth by what they called “reading it on the holly brod,” which seems to me to correspond with the *mis en carte* of the French. At that time (40 years ago) many could mount their own webs; now from the division of labour this has become a separate business.

868. How did you obtain the original casts from the Elgin marble, from which you made these smaller casts?—When I arrived in London in 1811, through the introduction of Mr. Murray, brother of the Lord Advocate, I was introduced to Lord Elgin, who gave me permission to draw from the marbles. He told me it was requisite for a member of the Academy to give a recommendation. His Lordship entered my lodgings one morning with a gentleman of the Academy, who after examining some of my drawings, medallions, busts, &c. spoke in very complimentary language of them. Lord Elgin said that I was desirous of being allowed to draw from the marbles; the gentleman answered in great earnestness, “To allow Mr. Henning to draw from the marbles would be like sending a boy to the university before he had learned his letters;” a few minutes after, they left me a little surprised. However, within a quarter of an hour his Lordship returned, and told me that I might begin to draw whenever I thought proper. Such was the origin of my studies from the Greek marbles. They were not in the British Museum then, but in a temporary building at Burlington House, Piccadilly. He gave me permission to draw, with this proviso, that I was not to make any publication without his permission, which I very willingly assented to. They were afterwards moved to the Museum, and I got permission of the Museum to continue my drawings there.

869. From whom?—The officer of the Museum, Sir Henry Ellis; he was then Mr. Ellis.

870. Did you at that time take any moulds?—No; for I still felt that with regard to Lord Elgin, I had no liberty to make any publication without his permission. Then, on their being introduced at the Museum, I asked my friend, Mr.

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Horner, who was then living, if he thought the Museum would allow me to publish them. He said he thought there would be no difficulty. I wrote to Sir Henry Ellis, who said there would be no trouble from the Museum. I proceeded with my drawing, and afterwards several gentlemen asked me to make small pieces in ivory; and that is a cast of one I have brought.—[*The Witness refers to a specimen on the table in white enamel glass.*]—I found in working on a round surface the sculpture in ivory, that every time I touched it the tool left a mark, and then I tried to make it smooth, I found, on account of its smallness, it was like labour in vain. I then thought that I could produce a better work by intaglio engraving; for by working hollow I found that I could introduce the veins and other minute work in intaglio, which must have taken immense labour upon the ivory.

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871. From whom did you receive encouragement to proceed with this work?—I was doing some modelling for the Duke of Devonshire, and the late Princess Charlotte, Marquis of Lansdowne, Earl Rosslyn, &c. &c.; they had seen my drawings, and some expressed a wish to have some pieces of the frieze of the Parthenon in ivory, from seeing my drawings, which were done eight inches high, being one-fifth linear measure of the originals; the intaglios are one-twentieth of the originals.

872. How did they become cast and sold cheaply to the public in this shape?—I cut them under this impression, that I could do them better on the slate. I first published the frieze of the west end of the temple, the entire composition of which is horses and cavaliers, some dismounted.

873. In casts?—In the sculptures of the west frieze we have but one piece of marble, No. 47; it is the first piece from the salient angle of the north-west corner; it was taken out of its case in my presence, and although I protested against it in very good humour, it was laid upon the ground under a window which admitted a considerable quantity of water upon it, for two winters; it now exhibits marks of the ravages of our climate on marble.

874. Of this size?—Yes, my reductions are the 20th part of the size of the original.

875. Who were the principal buyers of the casts?—The Duke of Devonshire, the Marquis of Lansdowne, the Duke of York and George the Fourth, with other nobles, gentlemen and ladies.

876. Have you found the sale for them extend through other classes of society?—No, not general.

877. Do you consider that you would have had a great number more purchasers for those articles if the law had protected you as fully as it ought to do in your original design?—I have no doubt at all about that.

878. Do you believe the public demand for those articles is almost unlimited, if the people had free scope for them, by giving the artizans the opportunity of seeing beautiful specimens of art, and protecting the artist when, by his original invention, he has discovered any way of promulgating it?—No doubt of it; I made no secret of it, I would not find fault if he copied; but it is another thing to take my labour.

879. Your labour in this instance consisted in filling up the defects which had been created in the frieze of the Parthenon, and re-forming them on that scale?—Yes.

880. And this, like many other inventions, has been pirated, and you have not been protected from the expense of bringing an action at law, which the statute gives you, and also from the want of a tribunal of ready access?—That is precisely the case.

881. Have you had experience in taking casts from larger statues in wax?—They could be taken of any size; but I have not had experience in larger ones.

882. As to the comparative expense of wax and plaster, considering the injury that may be done to the marble by taking frequent casts in plaster, have you any thing to state?—I apprehend that plaster is more proper than wax for that purpose.

883. Have you never known the surface of the marble injured?—That must be by a person who has no knowledge of the thing, if they injured it.

884. Have you heard complaints of artists, that the fine mellow colour which is given to the marble, was liable to be injured by taking casts in plaster?—No, it will be cleaner; the plaster is a very cleansing thing, it takes off every kind of dust, and a good deal of dirtiness it will remove.

885. Would not the taking casts in plaster frequently tend to slightly alter the colour

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colour of the marble?—I dare say it might, but if done by one who really understood what he was doing, I would not fear any danger.

886. Would that be the case if casts were taken in wax?—I apprehend that it would be impossible to take a good cast in wax from marble.

887. Would it be impossible to take a good one from the smaller bronzes, for instance?—If it is a mould in separate pieces, it is almost impossible you can make portions of a mould in wax; but to make a mould of an entire head or figure, I think it is impossible to make a good thing of it in wax.

888. Do you apply that remark to small works of art?—Small or large; if you use the wax for taking a mould from the round, it is generally done by pressure (unless it be bas relief); with wax you could not make it good.

889. But considering always the great importance of giving the most extensive circulation to the finer works of art, do you not think it desirable that some experiment should be made, as to the possibility of taking casts in wax, with a view to the prevention of injury to the marble?—Certainly.

890. And that the circulation of works of art of the first class would tend generally to improve the taste of the people?—I have no doubt of that.

891. You would think it advisable to engage every means by casts of giving every facility to try different materials (provided they did not injure the statue), in order to circulate the knowledge of the beauty of the original?—Certainly; but I apprehend we have nothing to compare with the plaster of Paris. I would just say as to arts in general, that it would be well if we were to adopt the plan I did with the Athenæum and the façade of Hyde Park Corner, I mean cutting it on the stone at once. We generally take a model and draw out by points that which is cut in stone. Now this shows the great advantage and the propriety of having the drawings in the first instance; every practical man, if he is inclined himself, should not only be able to draw things connected with his art, but if he cannot make his tools he ought to be able to direct them to be made.

892. Supposing the labouring stone-mason were instructed in the principles of drawing, one might suppose it would tend to encourage original works of art, and produce much more accurate copies of the finer ancient works of art?—No doubt; it would not at all injure those who choose to make gods and angels, or make their works for the drawing-rooms or cabinets. There are a certain sort of minds that follow their own track; if I had had the opportunity of a school, or rather museum, I would not have been an artist, but a mechanist or engineer; my pursuit in early life was geometry and mathematics, and their application to architecture, carpentry, mensuration, navigation, &c.

893. In your own case, have you had reason to regret the non-existence of such a school?—Yes.

894. What means were adopted to preserve the frieze of the Athenæum and Hyde Park Corner, from injury from the atmosphere of London?—It was waxed; I adopted it from a circumstance I met with 10, or 15 or 16 years ago; on my arrival in London, wherever I went, I was careful to examine the condition of stone buildings, the state of the wall of Somerset House towards the river attracted my attention; I saw something projecting from the stone, which on examining I found to be a shell, and I could not help reflecting that this could not have grown out of the stone, but the wasting of the stone must have exposed it, as the projections of the shell was at least half an inch. I concluded that Portland must be very liable to destruction, from the moisture to which it was exposed in this place; from this I was induced to notice, in some places, where the builder had not been careful to lay the stone according to what is called its bed, that it sometimes split with the lamina, and fell off in large portions when the lamina stood perpendicular. When I first went to see the façade of Hyde Park, I was surprised to find the cornice in some parts in a state of decay, although not three months from the chisel. I noticed something like crystals of common salt at a place where the stone seemed in rapid decay. I tasted the crystals alluded to, and they appeared to me the taste of common salt; thinking upon this, I thought it no longer any wonder that Portland stone should be so soon in a perishable state; on this account I suggested doing it with wax. It was also my intention to have suggested the propriety of doing the top of the gate with the wax, except where it was covered with metal, which I imagined might prevent the moisture from getting into the stone, and thus have a tendency to secure the durability of the building; but the fear that such an advice might have been reckoned fishing for a job, I had not hardihood to propose it. It will soon be seven years since the façade of Hyde Park and the Athenæum friezes have

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have been finished; it would be curious to inspect them to find which has best succeeded, or if either in preserving the stone. Mr. John Henning.

895. Were you the author of the mode adopted for preserving the frieze alluded to?—I do not know; I do not know if any other person had done it, but the first experiment I made was on a piece of polished marble; I took wax and made a stripe across it with a hair pencil; I contrived to warm it until the marble absorbed the wax, and left none on the surface. Then I mixed wax with a little turpentine, and I found that it went in further, but I found the wax went one-sixteenth of an inch into the marble. I put it on the top of the house for one winter; I found in the spring the polish was all off the marble, except where the wax was; that convinced me it must be of some use; and just about the same time I was employed to do a medallion of my friend Dr. Adam Ferguson, to be placed on his monument. I asked if the family would allow me to do it with wax; it was a piece of very beautiful statuary marble. I did it in this way, and Lord Burghersh having called on me and looking at it, he asked where I had got such marble. I told his Lordship that I had saturated it with wax, under the impression that it would preserve it in the open air; I showed him the piece of marble on which I had made the experiment, and it arose from that circumstance.

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896. Does it give marble any unpleasant gloss or polish?—No; it makes it like the finest preserved old marble that ever was seen.

897. How do you apply the wax to the marble?—We warm the wax; we have the marble warm also, and I take off any thing that is upon the stone, and leave nothing but what is within the stone.

898. You warm the whole bust or statue?—Yes; and have my wax as warm as I can have it, and take the best means to get off the superfluous matter; I take it off with soft cloth, or with cotton.

899. You also dissolve it in turpentine?—Yes; but it goes in so far, the wax, by itself, that it is hardly worth while; I believe wax is almost indestructible in the open air.

900. Do you think it is better without turpentine?—The turpentine makes it thinner, and it goes further into the stone; but I think if it goes in a sixteenth of an inch, it would prevent the water getting into any stone.

901. If it were a large statue, would it answer to have the turpentine dissolved and put on the whole statue?—I would begin at the top of the head of the statue, and have the wax as warm as I could have it, and have heated irons, so that I could without touching the statue let it come down until it came to the bottom, and you must have it clean.

902. Is it fine white wax?—Yes; but I suppose other wax will do it very well for defending stone; the white makes the least change of colour.

903. What do you consider the great advantage of this application of wax to marble?—It was, as I conceived, that the water getting into the stone, froze and destroyed it.

904. You consider the great advantage of your discovery is the preservation of the material?—That was my impression; I do not know if it deserves the name of a discovery; for any thing that I know, 10,000 may have thought of and done it before me.

905. Is any other object attained by it?—Not that I know of; it takes away the glaring white of the marble, and gives a softened tone to the whole, much like the best preserved old marbles that I have seen.

906. Then your discovery is principally useful in preserving the surface from the external effect of the atmosphere?—From absorbing the moisture of the air.

907. How long does marble so coloured retain the effects?—I think from what I have seen of wax that it is more indestructible in the open air than any other material I know.

Mr. John Martin, called in; and Examined.

908. YOU are well known as the painter of many eminent works; in your early professional education, had you occasion to acquire a knowledge of those manufactures that depend somewhat on the arts?—Yes.

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909. State what branch you became acquainted with?—That of coach-painting.

910. What information can you give us on this portion of the subject?—I fear very little; only with regard to art there is great deficiency in drawing and colouring, as we know by the works on coach panels, but there is capability of a great deal of improvement, with the assistance of schools, or rather museums.

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911. It would give, you think, a greater development to art?—Supposing at museums, such as the British Museum, there were professors capable of instructing; I mean for the study of the human figure, landscape painting, architecture, and every other useful branch.

912. Have you pursued any other branch of manufacture connected with the arts?—China-painting; when I first came to London it was just going out of fashion, for it depends on fashion when not sufficiently advanced by the assistance of art.

913. What do you think of the state of art in regard to china-painting?—It is very low indeed, in consequence of the deficient knowledge in drawing and the arts in general; I believe it has gone down considerably since Mr. Muss and Mr. Marsh (who was a very eminent flower-painter at that time) left it.

914. Do you suppose that instruction is required for the artist in china-painting?—Yes, a knowledge of drawing is decidedly necessary; it was their knowledge of drawing, &c. that made Mr. Muss and Mr. Marsh so superior to others; but owing to the decline of china-painting they were compelled to leave it; and it has since entirely gone to the ground.

915. When you speak of painting in china, do you include in that enamel-painting?—Painting on china is a sort of enamel-painting but that which is generally understood by enamel-painting is the style in which Mr. Bone and Mr. Muss attained such pre-eminence; that it is strange that so splendid and truly national a collection as Mr. Bone's "Eminent Characters of the Elizabethan Age," should not long ere this have been lodged in the British Museum or National Gallery.

916. Have you turned your attention to the difference or the relative state of china-painting in France and England?—I have seen some French painting on china, and upon the whole I think the finish is much higher.

917. Do they draw better?—Yes; the French are better draughtsmen, almost in every thing; I suppose they have a better opportunity of learning; besides it is patronized by Government.

918. You think for china-painting that instruction in correctness of design is very much wanted by our artists?—Yes.

919. For instance, you mean in anatomy, perspective and proportion?—Yes, every branch of the art might be obtained in a museum where every one is permitted to go; but there are no professors in the British Museum, and the students can only learn by seeing others draw on the spot from things which are worth drawing; the Elgin marbles for instance.

920. Do you not think it desirable that an artist should possess a knowledge of anatomy?—Certainly, for the drawing of the human figure or animals.

921. Might it not be desirable to give them opportunities of understanding *ab initio*, beginning with the skeleton, and going on to the whole proportion?—Yes.

922. And the study of the muscles?—Yes, and proportion, which has never been attended to.

923. Would a young man learn all these, according to this division of labour in the art, merely by a museum?—I think so, by proper masters.

924. You would have masters?—Yes; masters are necessary to give the proper direction to the pursuits of the student; but one master might teach two or three branches of the art, as follows: one master should teach anatomy and proportion; another, architecture, isometrical perspective and perspective; a third, landscape and nature in general; indeed professors might be appointed to teach every branch of art, science and literature; as in the British Museum every thing requisite is on the spot, and few alterations in the establishment would be needed. The National Gallery, and the National Gallery of Practical Science, might become branches of the British Museum. The grand object of a student should be to divide his time so as not to lose any, and not to give too much study to one pursuit or branch of the art. I firmly believe that the arts are useful to every branch of manufacture in the land; there is hardly a branch one can name that is not useful, from the lowest to the highest state of society; even to our legislators, drawing is useful, for they are not capable of judging of a plan without a knowledge of it; and they are consequently compelled to apply to practical men, and sometimes to dull-headed practical men, who are likewise often unacquainted with drawing, to have their opinion on any new principle in plans that may be laid before them.

925. Have you any other observations to offer as to china-painting?—No more.

926. You conceive, that were the artists instructed better in the principles of drawing, by improving the beauty of their productions, you would extend their sale?

—Yes,

—Yes, and it would not depend to much on fashion as it did when it was merely a passing thing except that it would pass into other countries, and the beauty of design and workmanship would be admired in foreign countries, and be valuable in the commerce of that article.

927. At present, in china-painting, do we invent designs, or simply copy old ones already existing?—When I commenced, I invented my own designs, but that was peculiar perhaps to me; Mr. Muss and Mr. Marsh used occasionally to design their own.

928. At present do we invent as much, or copy more?—It has fallen so low, that what is done is not worthy of being called invention; the French are beating us hollow.

929. Independently of extending the sale of works of art, you would think you would confer on them a permanently intellectual interest, were the artists well instructed?—Yes; when we understand drawing, we cannot bear to look at a thing ill drawn; it affects the feelings in an uncomfortable manner.

930. Do you not think that the Wedgwood ware, which is made from the cheapest and commonest materials, by being made of beautiful forms and being covered by beautiful designs, has attained a rank it otherwise could not have obtained?—Yes, certainly; they are beautiful works of art, and though of the commonest materials, we are delighted with the forms. Painting will only interfere with the beauty of the form when it is very excellent; it is a rule in composition never to put an ugly object before a graceful one.

931. You mean that genuine beauty becomes permanent, and independent of fashion?—Yes, accidental circumstances can never affect real beauty; I have seen beautiful pieces of china in form disfigured by bad painting; in consequence of that, I have my china generally without any painting, as I like the form undisturbed; and though the other cost more, I would rather have given the larger price for the plain china, than for that which was painted, unless, the painting was good.

932. Do you think china-painting might become an extensive means of developing designs?—Yes, it is perpetually before us; every day we see china; at all our meals the elegant and beautiful china is always before us; we are delighted with a piece of beautiful workmanship, and it might be rendered very cheap if there were a great number of clever draughtsmen as china-painters, but you could not find them now.

933. Few things come so constantly under the eye as china?—No, very few.

934. Can you give any information as to the state of glass-painting?—Yes, I was more occupied by glass-painting than any other branch before I became an artist.

935. Have the goodness to give the Committee such information as you have been induced to collect on the subject of glass-painting?—Glass-painting has fallen almost to the same level as china-painting; but it might be greatly superior now to what it was in ancient times. There is an ignorant opinion among people that the ancient art of glass-painting is completely lost; it is totally void of foundation, for we can carry it to a much higher pitch than the ancients, except in one particular colour, which is that of ruby, and we come very near to that. We can blend the colours and produce the effects of light and shadow, which they could not do, by harmonizing and mixing the colours in such a way, and fixing by proper enamelling and burning them, that they shall afterwards become just as permanent as those of the ancients, with the additional advantage of throwing in superior art.

936. Do you think that the glass-painting artist wants instruction in correctness of design as much as the china-painter?—Yes, more as it is a higher branch of art; but one of the greatest drawbacks of glass-painting, and the great cause of its being neglected, is this: it is so liable to be broken, that no person can venture to pay the artist sufficiently for his labour, on account of the thin and brittle material on which he is obliged to work.

937. You think there is a want of encouragement?—Yes, or else glass-painting must have surpassed all other branches of art in splendour, as it is capable of producing the most splendid and beautiful effects, far superior to oil-painting or water-colours, for by the transparency we have the means of bringing in real light, and have the full scale of nature as to light and as to shadow, as well as to the richness of colour, which we have not in oil-painting nor in water-colour.

938. When you were employed painting on glass, did you find the Excise laws present any great obstacle to the improvement?—Yes, that was the greatest obstacle. We intended to make experiments on plate glass; I did, and succeeded with it, but the expense of plate at that time, in consequence of the heavy duty, finally put an

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end to those experiments, as we could neither afford to purchase such expensive glass, nor to erect larger annealing kilns, for if not properly annealed, the glass is liable to fly. I believe I was the only person who made experiments on plate glass; they were supposed to be successful, only I could not afford to carry them on, for the reason before given. This is the principal cause of the fall of painting on glass, but if I could have made our experiments duty-free, I should have succeeded, for the plate glass is so thick that it would be safe from being broken by ordinary means, and it has besides another advantage, that plates can be obtained sufficiently large to obviate the necessity for those bars which interrupt the present works.

939. Are the artists who pursue glass-painting now well educated in drawing?—No, the want of that knowledge has helped its decline; Mr. Hedgland, the architect, Mr. Hoadly and Oldfield, are, I believe, the principal glass painters remaining.

940. At the present time you think the cause of the badness of execution is owing to the want of education in drawing?—Partly so; I should have painted some of my own subjects, as the effect produced on glass would be particularly adapted to them, if the experiments, &c. had been less expensive. I have always regretted the cost of the experiments, as works executed on plate glass on a very large scale would have been most magnificent in cathedrals or great public buildings; the knowledge and experience we had gained from our various experiments would have enabled us to produce grander works than have ever yet been seen in public buildings. I did not leave this branch of art without establishing a mode which has been and will remain in use as long as glass-painting is an art.

941. Why did you discontinue it?—I could not get a sufficient price for a highly finished work to pay for the hazard; I painted some very highly finished paintings which were purchased by Lord Ennismore, who was very fond of glass-painting, and I finished Mr. Charles Muss's works, when he died in 1824.

942. After you left glass-painting you became historical painter and engraver, and have executed your own designs?—Yes.

943. Is there any protection for copyright in those original compositions?—Not the least; for the expense is so great, that even if we gain our action we sustain great loss, and can only recover so much as we can prove have been sold; and it is no easy matter to prove more than the sale of one or two prints, although we may know a thousand have been sold; we are therefore ruined if we go to law. I have in my own person experienced great losses from the system, as the French copies of my works are brought over from France and sold in every part of the country. I was told yesterday that various shops in Windsor had got my works lithographed and selling at very low prices, to my complete ruin; and if I am not protected by some new law, I shall be compelled entirely to leave that branch of the profession by which I live; for my pictures are so extensive and cost me so much labour that I cannot subsist by painting, as very few can pay me 1,000*l.* or 2,000*l.*, and I cannot execute them for less.

944. What is the principal defect; this expensiveness of the law?—Yes, in a great measure; it costs so much money to carry the law into execution, and as it is not exactly clear, we are not sure after all that we shall not be beaten, though our proofs are ever so good. The person may come forward with false witnesses, and swear that he did not sell.

945. But you have obtained an injunction?—No, I cannot get an injunction; I applied for one to prevent a person from exhibiting a copy of my work in a sort of diorama of Belshazzar's Feast, in Oxford-street, and that person contested it with me. This diorama was a most infamous piece of painting, and the public were given to understand that I was the painter; this was ruining my reputation, and at the same time taking that from me which ought to be my own, my copyright. I ought to have the power of demanding so much money for permission, but this copy was made not only without my leave, but my name given as the painter. I endeavoured to stop the exhibition by an injunction, but was referred to a jury.

946. Is there any remedy that presents itself to your mind for protection?—Yes; I think I could be protected with regard to the law of copyright of engravings, &c. and take this opportunity of showing how incorrect is any opinion that may prevail as to the sufficiency of the present protection; for the plagiarist is not only safe from prosecution on account of the expense of such prosecution outweighing all the advantages that can be derived from a verdict; but as in my own case, he even comes into the field with a cheaper production, supported by all the effect of the advertisements, and other expensive means of publicity that my own performances had led me to adopt. He not only robs me of my ideas, but establishes a lucrative trade

trade on the effects of my pecuniary outlay ; wherefore I have always thought, and I still think, that the copyright should remain in the person of the designer, so long as he lives, and of his heirs so long as they possess the works, the same as any other property, unless, of course, there be a distinct written agreement to the contrary. That it should be so is obvious, but there is not in fact any real protection to copyright, owing to the uncertain state of the law on the subject. Supposing, for example, that in the case of pirated copies of my engravings, I do by chance obtain a verdict from a jury, I can only recover the amount of what I can prove the defendant to have actually sold, which is my sole compensation for the thousands that are known to have been sold, but which it would be impossible to prove by evidence, since open book accounts of such transactions are never kept. Or take another case, of a picture being copied for a dioramic or other exhibition ; suppose that on applying for the injunction, his Honour is not able to distinguish the difference between a picture of Belshazzar's Feast and a piece of lace, and leaves it for a jury to decide whether a diorama is to be considered a painting or a copy coming under the meaning of the Act ; all the satisfaction I obtain is heavy law expenses, with a certainty of an enormous increase if I hazard an action. The above cases are enough to prove that there is no efficient protection ; but there are many other ways of infringing a copyright, one of which is, that any unprincipled person may copy an early and most imperfect work, and publish it as if just executed, although the publication of such a puerile attempt would never have been sanctioned by the artist from regard to his own reputation. I will venture to suggest a method of protection ; a committee of gentlemen and artists might be appointed to sit at the museum about once in the fortnight or month ; say in the following towns, namely, for England, London, Bath, Liverpool, Birmingham, Hull and Newcastle-upon-Tyne ; for Scotland, Edinburgh and Glasgow ; and for Ireland, Dublin and Cork, for the purpose of receiving and registering impressions of original works, after which the copyright should be considered as fixed ; and all false copies found in any part of the United Kingdom, after the copyright has been fixed, should be seized. We should, likewise, have the power of seizing all foreign copies as smuggled goods, and treating the possessors accordingly. Thus no print should be protected unless deposited at the museum, or whatever other place or places might be appointed ; I think by that it would be put a stop to. I would have it at the British Museum, certainly ; it would be desirable also to have them in each manufacturing town.

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George Rennie, Esq. called in ; and Examined.

947. YOU have resided a long time abroad ?—I have been nearly eight years in Italy and different parts of the Continent.

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948. You have had opportunities of observing the different description of manufactures in demand in Italy ?—I have ; indeed I may say my attention has been drawn to this subject during my residence abroad, by observing the different description of manufactures in demand in the several countries I visited, particularly in Italy, which not being to any extent a manufacturing country, I was led to observe, that except in the plainest description of goods the French and Germans supply all the manufactures consumed there.

949. You were also led to make these observations being an artist yourself ?—Yes.

950. Having devoted your attention for many years to sculpture in Rome, you naturally turned your attention to those portions of manufacture connected with art ?—I was there studying my art, and I have long regretted the deficiency in knowledge of design so visible in English manufactures.

951. What is the result of your observation in the different descriptions of manufacture in demand in Italy ?—I should say that the cheaper and plainer description of manufactures are most of them English, such as plain calicoes, the commoner description of printed cottons, cutlery and earthen ware ; but I have found the shawls, figured silks, printed muslins, porcelain, and in fact every description of fancy goods, either French or German ; though the conviction on the minds of the Italians is of superior durability and solidity in the material of the English article ; I may say I have no doubt that if the English manufactures were equal in design to the French they would be preferred.

952. Has there been any improvement in design in England ?—English manufactures have improved since the French were more freely introduced. I should say by imitation rather than by any invention.

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953. Do you feel disposed to assign any reason why the French excel us in the description of goods where a knowledge of art and design is necessary?—From the facilities afforded in France for educating artists to design for manufactures, I am not aware that such means of instruction exist in this country for artists who apply themselves to manufactures as in France.

954. Do the French understand the correctness of drawing better than the English do?—They are decidedly superior to us in correctness of drawing.

955. What in your opinion would be the best means of affording the English manufacturer the ability to compete with the French in these respects?—I should say general instruction, which may be comprehended under museums and schools of art.

956. What do you mean by museums, galleries open to the public?—Yes, collections of casts, ornaments, &c.

957. In fact, works of art applicable not only to fine art but to ornament of every description, applicable to pattern or design in the schools; would the instruction you give limit itself to that which is required in the arts, that is, correctness of perspective, anatomy, a knowledge of proportion, and those branches of the art connected with botany and with chemistry?—I consider some branches of the arts necessarily require instruction, particularly anatomy and perspective. I consider it also highly desirable that every other branch of art should be taught, particularly botanical drawing. Though as to schools, I think it requires great consideration how far the Government ought to assist, because though at present it appears from the state of the knowledge of design generally throughout England, that there is an absolute necessity for some encouragement; at the same time great caution is required that too much should not be done. The effect of what I allude to, would be to establish a sort of central or general mannerism by too much legislative interference.

958. You would limit instruction to that which may be said to be positive, exact, and true in art, without allowing it to overstep those bounds?—I would.

959. Would you think it desirable to have a species of central and normal school for teaching those persons who are to teach others in different parts of the country?—Yes; I think it very desirable that some central establishment should be formed, by which I may say a central impulse might be given, without the branches being too much affected by that central influence, so as to reduce the whole to the same manner. I should say it would be very desirable that there should be a central museum in London, and in the provincial towns that there should be branch museums, where every species of casts and models, or means by which design might be promoted, should be transmitted from London to the provinces, and *vice versa*.

960. You would have a sort of central dépôt, and you would choose London as the nucleus of your instruction, because there is a greater opportunity of specimens of every kind of manufacture being seen in London, and all sorts of discoveries are immediately known both from the country and abroad sooner than any other portion of the United Kingdom?—I think so; I might exemplify it by saying, that unless there were a central system, probably one museum might become possessed of something it was desirable every museum should have; but without some general organization this could not be effected. What I allude to is casts from statues, original ornaments, &c. that could be cast, in plaster, and transmitted from the central museum to all the provincial museums.

961-2. You would have copies of works of art generally diffused?—Yes, and sent into the provinces.

963. Have the people better means of instruction by open galleries abroad than in England?—They have certainly; in fact, I might mention that in London there is not a collection of casts accessible to an artist at all; though in the British museum there are a number of very fine marbles, there is no collection of casts from the finest statues throughout Europe to which an artist can have access. The Royal Academy have a few, but the room is so small and badly lighted, that except to their own students, it is generally inaccessible; there is no collection of casts from which an artist could improve himself, and which it is desirable and necessary to have. I have felt in my own profession very much the want of such means, whereas on the Continent such collections exist in every town of any consequence.

964. You think such museums or galleries might be formed without creating any great expense?—I do, at a moderate expense.

965. Would you think it desirable to give the public an interest in them by themselves

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selves being owners to a certain extent; in the country towns, you would not make it merely a Government affair?—I think it is probable the corporations might be inclined to join the Government; I have no authority for saying so, excepting the case of Coventry, the mayor of which place informed me, that he had no doubt that the corporation would willingly assist.

966. Have you observed any of the mechanics' institutions; what progress they are making?—Intimately I have not; but I am justified in saying thus far, that there is no institution in England to any extent for the application of the arts to manufactures; in Edinburgh a society has existed for many years.

967. Do you think it desirable that institutions of this kind were formed, or that those already formed were extended to connect them with museums?—I do.

968. Do you consider it would be of great advantage to the public, and increase the consumption of works of art, if galleries were thrown open and the public made familiar with such works?—I have no doubt of it.

969. Might not the casting of works of art in iron be made more extensive and useful than it is?—I am of opinion that statues or works of any kind in cast-iron might be advantageously employed for adorning public walks and public buildings.

970. You have seen the ironworks at Berlin?—I have seen casts from them; I never was at Berlin.

971. Might not a central institution be of use in exhibiting the most beautiful productions of manufacture from every part of the world?—I think it highly desirable to have exhibitions of the finest specimens of manufacture.

972. Might it not be useful in procuring from countries like China, and from Cashmere or Thibet, the product of those countries, and would it not be a great facility for doing so, being situated in London?—I think an exhibition or collection of the best specimens of manufacture from every part of the world would be highly desirable in this country.

973. Would you have any registry or dépôt of patterns in a central institution or in provincial ones?—I conceive it impossible to afford the protection necessary for inventions and designs by any other means than by a deposit of the pattern and a registration.

974. You think the inventor is not sufficiently protected under the existing law?—Certainly not.

975. What additional protection would you suggest as desirable; what should be the mode by which that additional protection for them could be most practicable and would be the most simply and effectually attained?—I conceive it might be had in this way; if there were a central board in London, where a manufacturer, on producing a design, could deposit a copy and register it, that there should be branch boards at Manchester, Birmingham and all the principal manufacturing towns; and when the invention was pirated, the manufacturer should apply to the central or provincial board, who should summon the parties pirating the invention before them; and it would be desirable that the board should have a magisterial power to receive evidence on it, and convict summarily. I think the tardiness and expense of the law is one of the great causes of the want of protection at present. It would not be necessary for an inventor in London to deposit his patterns in every provincial town; for if a case arose in which an invention originating in London was pirated in Manchester, on the information of that being given, they might send the original pattern, or copy of it, to Manchester, and the offender might be convicted there; or *vice versa*, if the Manchester invention is pirated in London, by having a central board, the pirate of the invention could be convicted here.

976. Might not the inventor deposit one specimen of his work in the local registry or with the local tribunal, and the other with the central?—Yes; supposing the invention at Manchester or Birmingham, it would be rather expensive and unnecessary to deposit copies at every board. In fact, in some cases of models, it would be so expensive as to preclude it, nor do I conceive it necessary.

977. But in the case of its being copied, to prevent its being copied in a place remote from the place where the inventor resides, would you think it fair to the public that there should be a central dépôt in which every person, before he took out the patent for a new invention, before he made public a new invention, should have an opportunity of ascertaining if any thing of the kind had been previously invented?—I think it almost impossible that two people should originate an invention so exactly alike as to require such information.

978. Then would there be use in a central board?—I conceive that London being the great mart of every production, an inventor in the country should register

George Rennie, Esq. at the central as well as at his provincial board, to give him more efficient protection, and I think it highly desirable that the Board should have magisterial power to convict summarily.

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979. Might not that power be equally used by the local Board?—Yes, I consider the local board should have the same power.

980. Would not a local registry have the effect of stimulating the inventive powers of those artists by the registry, being open; would it not serve as a dépôt, and have the effect of stimulating the inventive powers of other artists as well as the inventor?—That would, with other means of facilitating the instruction in design.

981. And raise the public taste?—I think the standard of public taste would very soon be raised, by opening a museum in every town. It is allowed that the public taste has improved greatly as regards manufactures, since the French patterns have been introduced. We may expect in the same way if museums were opened generally, the public taste would be improved, and it would give the artists the opportunity of instructing themselves.

982. Even the simple fact of there being an open gallery in which those specimens of invention of patterns were exhibited, would have the effect of diffusing the knowledge of new patterns, and of stimulating the inventive powers of the artists who saw them there, as well as those who attended in public galleries, would it not?—I conceive it would; an exhibition will always stimulate invention.

983. In fact, you think that encouragement without interference would produce very great effect in advancing knowledge in manufacturing towns?—When I alluded to non-interference, I think the danger of establishing schools is not that there is danger of giving assistance, but it is in establishing every school on exactly the same system, so as to destroy the individual character of the separate school, although I think it quite necessary there should be a central system to give encouragement without absolute control.

Mercurii, 19^o die Augusti, 1835.

WILLIAM EWART, ESQUIRE, IN THE CHAIR.

James Crabb, called in; and Examined.

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984. WHERE do you reside?—At No. 8, Shoe-lane, Fleet-street.

985. What are you?—I am chiefly engaged in the designing and the execution of fancy works, particularly with regard to the arrangement and decoration of rooms; for example, this design is my own [*producing a drawing*], and I can execute it as well upon the walls as upon a small scale.

986. You are a designer, then, for ornamenting rooms in various styles?—Yes.

987. Have you ever been induced to notice any difference between the English and French designs for papers of the best description?—We find the French papers are superior in design, both in the original idea and in the detail of the drawing; they appear to understand their subject very much better than we do in England.

988. Do you deal both in English and French papers?—Yes, we do.

989. The execution of the French papers shows that they are drawn by persons who receive a much better education in that art than anything we have in England?—In England we have no schools to obtain such instruction; the foliage of this [*producing a French paper, landscape and figures*] is very beautiful; the superior style in which the whole is executed shows that the designer must have carefully studied the aerial perspective of the colouring, as well as the general form and design; the spirit and truth of the animals surpass any thing we should accomplish for a similar purpose in England.

990. You have been induced to make these observations before you heard of this Committee?—Yes; I never heard of it till yesterday; all these specimens are prepared in our ordinary mode of business, [*producing several*].

991. Have you, as an English artist, ever been led to reflect on the propriety of having instructions given to those who, like yourself, are engaged in works of design connected with the decoration of houses?—I am continually finding the want of it.

992. You do not find the journeymen are sufficiently instructed to produce works such as the journeymen of France produce?—Decidedly. In the instance of

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of the French paper produced, the printing of it requires a certain degree of taste and knowledge in the actual application of the colours; and if we had the same blocks, I do not expect there would at present be found in the English journeymen sufficient intelligence to print or produce the whole design equal to this French specimen.

993. Explain what you have just said with regard not only to our inferiority of design, but our inability to transfer that design to the paper?—I think it want of information in the workmen. I apprehend that the workmen in France must have a certain degree of instruction given them with respect to the mixing and most judicious mode of applying their tints. In the designs for a French landscape paper, the aerial perspective is usually beautifully attended to in the printing, as well as correctness in the botanical features; and unless the journeyman had the subject familiar in his mind, he could not execute the work with the freedom with which it is evidently done; for instance, I expect that this colour, which here represents a cloud of dust, is put on in a body with a brush, and then softened and made to assume its present form with a sponge; this is the journeyman's own act, and he must have been instructed how to convey the idea, or he could not do it, especially in the distant foliage, where the same plan is pursued with beautiful effect.

994. Then you suggest two points; that the original designer for this class of paper is better than any English one, and that the inferior French workman is a better artist than the English one?—Decidedly; their taste has been cultivated and corrected.

995. This is printed by the common process of printing, is it not?—Yes.

996. By wooden blocks?—Yes; the block-cutters are not inferior to those in France; but I may say that if we had the very same blocks with which this set of paper is printed in France, we in England should not get so good and well-executed a paper.

997. You mean to say, that having the French blocks, you could not get it printed by English printers as well as this is done in France?—Yes.

998. Because in the paper printing also a certain portion of time is occupied by elementary education in France, which our workpeople do not receive?—Yes.

999. And that refers to the finishing, after it has gone through the process of block-printing?—No, this is in the process of printing; there is no superior or foreman in a manufactory who could possibly attend to all these little things, which nevertheless give the work the superiority it possesses; they must be done by the intelligent journeyman, assisted by the artist's general superintendence. In England, the landscape painter must be employed to supply such a design as this, and his time would be too costly to be employed in superintending the execution of it; we want a lower rank of ability, one that the manufacturer can afford to employ throughout his work. As regards English papers for ordinary rooms, there is a great variety of beautiful patterns published.

1000. Is the English taste for superior designs in paper much advanced lately?—Yes, I consider it has; there are finer patterns produced than formerly, especially flock papers; but we have yet as many inferior designs as good ones. I think the taste which has prevailed for some time, of colouring the walls of principal rooms a plain colour, is declining; the style of Louis XIV. and others of a rich character are being adopted.

1001. Now in the carving of the designs for picture frames and glasses, do you find the same deficiency among the English workmen that you have spoken of among the workmen connected with paper?—Yes; we find the greatest inaccuracy in the carving of fruit or flowers; we find them very bad indeed occasionally.

1002. Have you any information yourself respecting the elementary instruction of journeymen and workmen in France?—None at all.

1003. How did you attain your own skill in designs?—Principally by my own exertions; I have never had any sort of information given me; my father is a designer, and of course I have always been accustomed to see it, but I have never had any sort of introduction to works of art.

1004. Then you consider your education has been a private one?—Entirely.

1005. What benefits have you derived from any public instruction given in this country?—None at all.

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1006. There are no public schools open, or mechanics' institutions, to which you have been invited to resort by their publicity and economy?—Not any.

1007. The galleries of this country are open to you?—Yes.

1008. What galleries have you resorted to, as the means of instructing you or your hand in the execution and in the principle of designs?—The only ones are, the British Museum and the National Gallery; I have found great assistance, in respect of colour, from the paintings in the National Gallery.

1009. Since that has been established?—Yes.

1010. And therefore the inference is natural, that such galleries are of the highest importance to gentlemen engaged in such a trade as yours?—Yes.

1011. You consider it so?—I consider that the more extensive our acquaintance is with works of superior art, the more original and correct our conceptions would be.

1012. Have you been led, from your own personal experience, to think that public instruction to persons whose trade is connected with designs, would be a benefit to them?—Yes, I consider it would.

1013. That is your opinion; have you heard others similarly circumstanced to yourself express similar opinions?—Yes, occasionally I have.

1014. Did you ever obtain any assistance, by means of casts, from the better specimens of sculpture in the Museum or elsewhere?—I should derive assistance from them if I had the opportunity, but I have not time.

1015. It would be a matter of some importance to you, and those connected with the art of designing, could they obtain cheap casts of the finer statues and bass reliefs?—Yes, in many cases.

1016. What would be the ordinary education of a person intended for your profession?—He would be apprenticed.

1017. To whom?—To one who carries on the business of a designer, or decorative painter (a separate business); he would not be apprenticed to a general house of business, like Mr. Trollope's.

1018. Then after he had passed through his apprenticeship, would he be considered in a situation to commence business for himself, or would he pass through any intermediate education or study before he commenced designing?—A youth is apprenticed, and immediately is put on such work as it is found he can do inferior portions of, the patterns of his master; and he continues doing what he is able progressively; if he has ability or inclination to pursue the study of drawing in any way during his leisure hours he does it, but seldom receives encouragement and assistance to do so at any other time.

1019. What mental education is considered necessary to be given to him at the same time?—He has none; the same course is pursued through the whole apprenticeship.

1020. Then there is no knowledge of the antique given; any classical allusion that he makes in his designs is quite chance?—Quite chance.

1021. Supposing that you were set to design a series of decorations, and were given a particular subject to exemplify, for instance, the history of Cupid and Psyche; supposing that you were not possessed of more than an ordinary degree of information in your profession, how would you proceed to execute those designs?—I could not do it.

1022. Then if you had an order of that kind, would you be obliged to have recourse to artists not connected with your own profession to give you the designs?—If I had an order of that sort, and I found that the French paper of that subject executed, and now existing in France, would not answer my purpose, I should inquire of English artists by profession their charge for designing such a subject, and of the printer the cost; but I apprehend that the cheaper way would be to go to France, where without difficulty I could obtain both the design and the paper made to my order.

1023. Then you suppose that in France gentlemen in your profession would themselves have requisite knowledge to execute works of the kind, without having recourse to an artist?—Yes, their pencil would be sufficiently correct.

1024. Then art is cheaper and goes lower in France than it does here?—Art is more general, and it is cheaper from being better and more universally understood.

1025. Then it should seem, that provided you had the design, you could execute it afterwards in this country?—Yes; but in both cases at much greater expense.

1026. Then

1026. Then we are only inferior in designing, not in the execution of designs?—In the execution of such a paper as that we are inferior [*alluding to a French paper*], because they have more intelligence among the workmen.

1027. Does that arise from having so many colours upon it?—It arises from the taste which is necessary to execute the subject; you do not see much of it here, but in some parts the distant foliage is very good indeed.

1028. Is any part of this done with a pencil?—None.

[*The Witness exhibited a Drawing of his own to the Committee.*]

1029. In the drawing which you have now laid before the Committee, the Committee perceive it is taken from the Elgin Marbles; did you draw this from the original or from casts?—I drew that and others from an engraved outline, and corrected it by occasionally visiting the Museum, and on my return correcting my drawings.

1030. Is there any engraved outline of this size?—No, it is 20 inches high.

1031. Then how did you execute this; did you enlarge from a smaller copy?—Yes, I enlarged from one about four inches by six.

1032. Do you find an increasing taste for subjects of this kind?—If I had time and opportunity I should pursue them, and expect patronage from gentlemen of taste.

1033. But is there an increasing taste among general purchasers; do you observe a greater demand for patterns or specimens of the antique taken from Pompeii, or from the classical models, than there formerly was; is that taste increasing in the country?—I think it would increase if there were opportunities for satisfying it; but the expense is at present too considerable for general patronage.

1034. Might not one means of increasing it be the diffusion of elementary education in arts and designs, so that you might employ men at a cheaper rate capable of executing works of this description?—Decidedly; for instance in that pattern [*alluding to the drawing of the Elgin Marbles*], having had no instruction as to the general proportions of the horse and the figures, the difficulty, supposing I had a quantity to execute, would be very considerable, because I must make drawings of the whole to a scale first; now, if I were more conversant with the proportions, I could execute it without, and in that case I could make quite as much money, and the work would be done cheaper, by being done with facility.

1035. Now to what purpose do you propose to apply paper of this pattern?—The idea was to introduce them below the frieze in a dining-room, or on stair-cases, in sunk pannels.

1036. So as to produce the effect of a bass relief?—Yes.

1037. And you think if paper of such a pattern be executed cheaply, that is, if our journeymen workmen could assist in executing such patterns, that there would be a great demand for them?—They certainly would be then extensively employed, either painted or printed; we should have an opportunity of employing them now, but for the expense of executing.

1038. Do not the pattern-drawers for calico printing furnish you with many patterns?—We borrow from each other.

1039. That is, you copy their patterns from printed furnitures?—We copy their ideas, although the actual design may not be copied.—[*The Witness exhibited another Drawing to the Committee.*]—Now that is applicable to our business, but not at all to calico printing; that is an arrangement, an idea of colouring of my own, the subject done from an outline engraving.

1040. Is it the practice of your trade to have patterns furnished by the calico printers?—It is not.

1041. It is a distinct business?—Yes.

1042. Do you find a want of instruction in architecture?—In every branch of decoration.

1043. And is it your opinion that schools or institutions liberally established for the purpose of instructing persons like yourself in the correct principles of design, and in extending their knowledge of the arts, would be very beneficial to them?—I consider it would, by enabling them to express their ideas with freedom.

1044. Is this drawing that you have handed in to the Committee done by yourself?—Yes.

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1045. In all its parts?—Yes.

1046. Is it copied from any original done by any other artist, or is the design yours?—The design is mine, but the paper itself is a French paper.—[*Some more Drawings were handed in to the Committee.*]—The drawings which I now hand in are drawings to a scale, from a paper designed by Mr. Jones (who is one of the first decorative artists), in the copying of which, the reducing to a scale, I find there are inaccuracies, which, if that gentleman had received an architectural education, I mean to a limited extent, suitable for decorative painting, he would not have committed. This drawing is a French design for a dome ceiling; it is printed in perspective; we have nothing of the kind in England, and its drawing and general execution is very superior.—[*Two more specimens were exhibited.*]

1047. You have two specimens there before you, one French and the other English?—Yes.

1048. Is one a copy from the other?—No, but I apprehend the mode of printing the English one has been copied from the French one, from the mode in which the French one is done. I apprehend these specimens of French paper were imported for the purpose of assisting the printing of English paper, not for this pattern alone, but various others which have been introduced by the same house in the same style as this French one.

1049. What do you consider to be the best qualities of that French paper?—The superiority of the drawing, the elegance of the lines, and the variety which is given to the colour.

1050. Is it more true to nature?—Yes, that is in the correctness of the drawing.

1051. In fact, there is a better knowledge of botany in it than in the English one, is there?—Yes, there is none at all in the English one; no knowledge of botany shown; in the French there is decidedly.

1052. Is that English paper of the botanical pattern which you have just compared with the French one, of the best of English paper, or not?—It is the best of the kind.

1053. Have you any other practical illustration to hand in, or any observation you wish to make with regard to flower-drawing?—Yes,—[*Some more were exhibited to the Committee*]—these are all French flower borders, which are very well executed; they are most beautifully drawn.

1054. Do you think in England they would be so well done?—No; I think that one of the best we have [*exhibiting another.*]

1055. Then you exhibit a pattern of the best English flower-drawing for paper border, and what, in your opinion, is the difference between that and the French one that you have before you?—In the English pattern, the leaves are not those of the flower, which is an inaccuracy that we never find in the French; they use the leaves of each respective plant with the finest possible effect.

1056. Now with regard to the colour, are the colours of the two patterns different?—Yes, the French are superior in brilliancy.

1057. What is your opinion with regard to the effect and combination of the colours of the flowers?—The effect, contrast and combination of the colours, as well as form, are superior in the French; this facility of adapting the forms and colours most gratifying to the eye, must be the result of early and continued acquaintance with flowers and plants.

1058. Where are these French papers made?—In the neighbourhood of Paris.

1059. Can you state any thing as to the comparative price between Paris and England of similar papers?—I do not know of any bordering in England that we can get to use for the purpose.

1060. You have said it is desirable that the manufacturing population in your line should have some instruction as to the mixing of colours; how would you propose such instruction to be given?—I am not aware of any information that is given with respect to the harmonious arrangement of colours; for instance, here is a drawing, and there are others amongst those in which the colouring is entirely my own idea, but it is done without rule. In France they would do it on a fixed principle. I am not aware of that rule, except just in a superficial way. The French colours are also themselves more brilliant than any printed English ones I have yet seen.

1061. By rule, do you mean certain proportions?—No; there are certain quantities

quantities of colours which must be used in certain places, in order to produce a good and judicious effect.

1062. There is a principle established then, is there?—In all the fine paintings of the ancient masters you find an equality of colour, and it is the same in our work; but we are not instructed; we labour till we obtain an effect that pleases our eye; and this is as often wrong as right.

1063. Do you mean in France, there is any thing like elementary instruction in the science of colouring, for decorative artists, &c.?—No doubt there must be.

1064. Have you any positive knowledge of it yourself?—I judge from the effects produced.

1065. Have you any further observation to make on the specimens you have brought with you?—Nothing further than upon the general want of information which we find. My preceding remarks are not limited to printing, but apply generally to interior decoration.

1066. Is there any want of talent among those who, like yourself, pursue this branch of trade?—I apprehend not.

1067. It only wants free scope given to it, and proper instruction?—Exactly, they want opportunities in early life to make themselves generally acquainted with the various proportions of the human form, animals, architecture and especially botany, and the principle of combining colours to form pleasing effects.

1068. You have never been in France, have you?—No.

1069. Then you form your opinion, not from having been in France, but simply from the works you have seen, both English and French, in this country?—Exactly; and the deficiency I find for want of such public instruction as I apprehend might be given to all branches with success.

1070. With regard to the decoration of rooms, or any other subject of the kind, do you wish to express any opinion you have been induced to form?—No; we find constantly that there is a person who must be consulted in the decoration of the room, and it is very important that that person should have the information which I state is wanting in England with regard to true taste and fine combination in the colours and design to be employed.

1071. Then the principal deficiency is the want of correctness of drawing?—A want of an easy and correct mode of obtaining the knowledge of it.

1072. The want of knowledge of perspective?—Yes, as applied to decorative works.

1073. The want of knowledge of architectural drawing?—Yes.

1074. And what other head?—The want of knowledge of the principle of colouring; we have no certain principle to go upon; all these advantages may be obtained in England at present, but at a great cost; they are not attainable by those whom it is necessary should have them.

1075. In the practice of their trade?—I mean in the general use of our business; there are works of art, engravings and works of great merit which will never come under our observation, although we know they are in existence, and would be of invaluable assistance; they are in the libraries of architects and men of superior fortune and talent, and we have no access to them, which, if we did have by means of a public institution, the general taste would be wonderfully improved and extended; it furnishes able men to direct the student, and is a repository for fine examples of art.

1076. You believe the general labour in a paper-hanging manufactory is inferior to the French manufactory?—It must be.

1077. And therefore it is desirable that the journeyman manufacturer should have a degree of information which our journeymen do not possess?—An intelligent manufacturer, I apprehend, at the head of a business of this kind, would give to his foreman and principal workman opportunities of obtaining that extended knowledge which might be obtained in England through a public institution; he would make a point of doing so for his own advantage.

1078. Provided there was a place open for their instruction?—Yes; now a botanical garden would be of the highest value; for there is scarcely any thing where, in some form, botany is not introduced, and the more extensively you are acquainted with it the better; you get more beautiful lines, more original effects and finer forms than you do by any other means; and the same with foreign birds; occasionally you have fine birds and colouring to introduce, and

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where you have an opportunity of studying them at your leisure from nature you can, when required, introduce them and other objects with facility. We find no colouring equal to that of nature; the illuminated missals are also applicable to our business.

1079. You want extended power of observation by facility of access to every work of the kind which you describe?—Yes.

1080. And that would draw out a great deal of talent which is now not drawn out?—Yes; I apprehend superiority in all branches; we should be able to amass a stock of ideas to be combined and varied as occasion might require.

1081. Would it be a great advantage to you to have the means of studying the drawing of birds from nature itself in the Museum, &c.?—Yes, it would; and it would be still an increased advantage if we were allowed access to it early in the day; I can avail myself of no advantage unless it is before breakfast.

1082. Now, with regard to the British Museum, supposing you could have access in the summer from six to eight, in order to design from any of the statues of marble or friezes there, would or not that be great advantage to you in your trade?—It would; it might be a very great advantage.

1083. If it were open to you to pursue information and acquire knowledge at a time that you could beneficially spare it for that purpose?—Yes.

1084. In the morning and also in the evening?—Yes; but in the evening with less advantage.

1085. Then if it were so open to you, you would go there in fact?—Certainly.

1086. And you apply that generally to other collections of art in which your ideas might be assisted in general?—Yes.

1087. And do you conceive that your observation applies to other persons in the trade as well as to yourself?—To all situated as I am.

1088. You are so engaged throughout the day, that it would be an essential benefit to you to visit these galleries and places or public institutions in the morning or the evening?—Yes, morning or evening.

1089. Have you ever made any application to the Trustees of the British Museum with a view to being admitted early in the morning in order to study the antiquities, &c.?—I have not; I have not had occasion to apprehend it was necessary. But supposing that I had had a series from the Elgin Marbles to execute [*alluding to the Drawing before shown*] in a gentleman's house, then it would have been of the greatest importance to me.

1090. Then supposing you were to have an order for paper with the design you have put in, being a design taken from the Elgin Marbles, you would then find it a great advantage to have an opportunity of frequenting the Museum early in the morning?—Yes.

1091. And should you in that case make application to the Trustees for permission?—As it now stands, I should certainly, though I do not apprehend it would be granted.

1092. Have you ever turned your attention to the embossing or ornamenting of leather in lieu of paper for rooms?—Yes, but without success.

1093. Have you ever seen any specimens of ancient leather so embossed and ornamented?—Yes, I have, many.

1094. Is it an art at all followed or understood in this country at present?—Not to the extent that it was, not for rooms; it is merely for the backs of superior books, and various things of that kind, but to no extent.

1095. It used to be made in this country for rooms, did it not?—No, principally in Holland.

1096. Upon the whole, is paper-hanging increasing?—The taste for superior decoration is increasing; in noble rooms it is the style and whole effect that marks our taste, not merely the paper.

1097. Is its consumption increasing?—The consumption was always very large, but I think the taste wants more general improvement with regard to the adaptation of the patterns, the arrangement of the paper and its embellishments, a particular always attended to by the French, than in the execution of our ordinary bed and sitting room papers. There is not sufficient knowledge among the master paper-hangers as well as the inferior workmen, the persons who direct the work; there is not that taste there should and might be, by more
widely

widely diffusing a knowledge of the beautiful effects to be produced by combination of colour.

1098. And you are persuaded that the more general knowledge of the artist would tend very much indeed to increase the consumption and improve the arrangement of all these domestic embellishments?—Yes, not only with respect to the executors of the work, but those who propose to have it executed; with the general public there would be a better taste.

1099. Are there any other points on which you wish to observe?—I am not aware of any thing further that I can add beyond the idea that a gallery for exhibiting works of original design would be an advantage.

Veneris, 21^o die Augusti, 1835.

WILLIAM EWART, ESQUIRE, IN THE CHAIR.

James Skene, Esquire, called in; and Examined.

1100. WHAT are you?—I have been secretary to the Board of Trustees for the Encouragement of Manufactures in Scotland since January 1830, and am also secretary to the Royal Institution for the Encouragement of the Fine Arts in Scotland.

1101. Have you had any opportunities of acquiring information with regard to the advantage which manufacturers may derive from an increased knowledge of the arts of design?—My opportunities in that respect have been during the greater period of my life; I was educated abroad, and stayed in one of the foreign academies of design for three years, when a young man, and since that period I have been about ten years in different countries, and being fond of art myself, I have paid considerable attention to that subject.

1102. Will you state to the Committee when the Board of Trustees was instituted, and what is the constitution and object of that board?—The Board of Trustees was instituted at the time of the Union of England and Scotland; in consequence of some alteration that took place in the customs and duties connected with the two countries, a sum of money became due by England to Scotland, payable to different establishments and different individuals. The surplus of that sum was appointed by Government by the 15th article of the Treaty of Union to be employed in all time coming for the encouragement of manufactures in Scotland. That was the first establishment of the Board of Trustees in the year 1807; at that time an annuity of 2,000*l.* was appointed to be paid for seven years to the board. That was the first grant. The board, nevertheless, was not established till the year 1727; there came to be accordingly arrears of that 2,000*l.* for seven years, which made 14,000*l.*, which was then paid to the board, as also a sum of 6,000*l.* of farther arrears after the annuity had been made permanent, and laid the foundation of their funded property. The grant of the 2,000*l.* was then rendered perpetual, and they have ever since received that sum.

1103. What is the whole amount they receive?—Various alterations have taken place in their proceedings, and their funds have been considerably augmented; some of their funds being in the public securities during the war, and exceedingly well managed, considerable savings were obtained by that means; so that now their funds consist, in the first place, of the annuity of 2,000*l.* payable by Government; they have the sum of 30,000*l.* at present in the hands of the Water Company of Edinburgh, for which they receive the interest; they have 15,000*l.* in the hands of Mr. Innis, of Lochalsh, also yielding interest; they have a sum of 1,000*l.* in the hands of the town of Edinburgh, which at present yields no interest, as the town is bankrupt. They built the Royal Institution, a large building in Edinburgh, for the purpose of accommodating different learned bodies there; the Royal Society, the Royal Institution for the Encouragement of Arts, and the institution for antiquities (the Antiquarian Society as they call it), and also for the accommodation of the Board itself; they receive rents from those other societies which amount to the annual rent of 740*l.*: that constitutes the fund.

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1104. What is their annual income applicable to the purposes of the Board?—

[*The Witness delivered in the following Paper :*]PRESENT STATE of the FUNDS and EXPENDITURE of the BOARD of TRUSTEES
for MANUFACTURES in Scotland.—*J. Skene, Secretary.*

THE Board of Trustees for the Encouragement of Manufactures in Scotland derives its origin from article 15th of the Treaty of Union between England and Scotland, in terms of which a sum having become due by England to Scotland, as an equivalent for certain alterations in the respective revenues of the two countries, a portion of that sum was converted into an annuity of 2,000*l.* redeemable by Parliament at any after period, by payment of 40,000*l.* This annuity, or its redemption price, to be employed in all time coming for promoting the fisheries and manufactures of Scotland.

The annuity having been allowed to remain in arrear, until the Board of Trustees was actually constituted in the year 1727 (13 Geo. I. c. 26. 30.) the arrears being paid up, gave rise to the funds now in the hands of the Board, and to which subsequent additions were from time to time made by savings, the advantageous sale of stock in the public securities, and of property purchased at a low rate for the purposes of the Board, and afterwards sold to very great advantage.

A further sum of 2,956*l.* 13*s.* 8*d.* was granted by Parliament under the Acts 10 & 27 Geo. III. for promoting the growth of flax and hemp in Scotland, but this sum has now been withdrawn by Government; and a further reduction of the funded property of the board took place, by an order to pay out of that fund the sums of 8,000*l.* to the Botanical Garden, and 1,000*l.* to the Astronomical Institution of Edinburgh.

The present state of the fund, of the burdens affecting it, and of the sum remaining for carrying on the purposes of the board, are as follows:—

	£.	s.	d.
1. The annuity, payable in discharge of equivalents due to Scotland - - - - -	2,000	-	-
2. £. 30,000, bearing interest, 3½ per cent. - - - - -	1,050	-	-
3. £. 15,000 - - - - -	525	-	-
4. £. 1,000 in the hands of the Town of Edinburgh, not yielding interest at present - - - - -	-	-	-
5. Rent of the Royal Institution, built out of the funds of the Board - - - - -	740	-	-
	£.	4,315	-

The Fund is burdened as follows, by Grants ordered by Government:—

	£.	s.	d.
1. To the Royal Institution of Arts - - - - -	500	-	-
2. To the Agricultural Museum - - - - -	300	-	-
3. To the Horticultural Garden - - - - -	200	-	-
An annual sum, payable as compensation annuities to Stamp-masters deprived of their offices, by repeal of the Linen Acts - - - - -	1,076	-	-
The Drawing Academy, including feu-duty of ground - - - - -	430	-	-
Further expense in coals, lighting, taxes, repairs and contingencies - - - - -	230	-	-

SALARIES to Officers of the Board:

The Secretary - - - - -	£.	-	-
First Clerk - - - - -	420	-	-
Accountant - - - - -	240	-	-
Allowance for house to ditto - - - - -	50	-	-
Messenger - - - - -	50	-	-
	760	-	-
For new casts and other expenses attending the gallery - - - - -	100	-	-
Sum left for promoting the objects of the Board, and covering incidental expenses - - - - -	719	-	-
	£.	4,315	-

N.B.—It is to be observed that the annuities to Stamp-masters, as most of them are men of advanced age, will progressively fall in for the benefit of the funds of the Board.

1105. What means have been taken by the Board of Trustees to extend the knowledge of the arts, principally of designs, among the people of Scotland, particularly the manufacturing population?—The principal means which the Board have followed for that purpose has now been in operation for about seventy years; about seventy years ago they established a school for drawing, being

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being aware of the advantage which foreigners possessed over this country as teachers of design at that period; they got a person of the name De La Croix, a Frenchman of considerable skill, who set that institution a going; it was for the accommodation of forty pupils taught by one master, and the pupils are admitted gratis. They offer specimens of their capacity and certificates as to character to the Board of Trustees, and they judge of those who are to be admitted, giving the preference to those who seem the most deserving of it. It is an establishment which very soon rose into great repute in the country, and has continued exceedingly successful ever since.

1106. Has the number of pupils increased?—The number of pupils has not increased; it still remains the same establishment, with only one master. It has been managed since the period of its first establishment by a series of very eminent teachers. The person who now holds it, Mr. William Allen, is the first artist in Scotland. The Board contemplates extending it, and they are at present taking measures for that purpose. Hitherto it remains on the same footing, only forty pupils, but so great is the demand of the public for the extension of it, and so high does it stand in their estimation, that although there are about four or five elections of pupils in the course of the year, there generally are at least ten candidates for every single vacancy that occurs, and it comes to be a matter of very disagreeable administration to the Board to reject so many young men from having instruction in the art of design, when they seem desirous to obtain it.

1107. Do these young men afterwards devote themselves to that part of designs connected with manufactures?—They are principally engravers and statuaries, also artists, coach-painters, house-painters, and manufacturers; persons of that kind.

1108. Do you happen to know whether Mr. Wilkie was educated there?—I believe there is not an eminent name in the history of art connected with Scotland where the individual has not been educated at that academy. It has produced the most eminent men, either as artists, engravers, or as connected with any of the corresponding professions; in fact it has done a world of good to the country.

1109. Do persons recommend young men for introduction to that establishment from the distant provinces?—Oh, yes, from every part of Scotland.

1110. Will you state how they are selected?—They produce specimens of their talents for drawing; they produce certificates of their good character; the Board is very particular upon that subject: also if they are apprentices they produce certificates from their masters that they will give them the means of attending, and then all these are examined by the Board of Trustees; and that young man whose name perhaps they are ignorant of, but that young man whose qualifications seem best, is the person elected. The only preference they seem disposed to give is to the younger classes of them in preference to older ones.

1111. Do you know if Mr. Wilkie was educated there?—Certainly he was.

1112. Any other engraver do you recollect?—Mr. Barnet, Mr. Wilson, Mr. Allen himself; in fact all the artists of any eminence connected with Scotland have been educated there.

1113. This school and the Royal Institution are at Edinburgh?—Yes.

1114. Have there been any subordinate schools in any other part of Scotland connected with the Board of Trustees?—The Board of Trustees established a branch school for the express purpose of teaching the pattern drawing for table-cloths, diaper, and matters of that description, at the town of Dumfermline; it was upon a particular system, and the Board engaged to give fifty pounds a year to a master, provided the manufacturers of Dumfermline would contribute an equal sum. They did so, and that school was in operation for a good many years; I do not exactly recollect the number of years, but for a good many years, and was exceedingly beneficial, and, in fact, was one of the great causes, in conjunction with the encouragement of premiums for the best articles of manufacture given annually by the Board, of raising the establishment of linen manufactures in the town of Dumfermline. Last year the manufacturers declined contributing any further to it, because it had been reduced to a few only, who contributed their proportion, and these few, two or three of the manufacturers, said the burthen was too hard, upon them, and they could not contribute any longer, wishing the Board to advance the whole sum of one hundred pounds. That was incompatible with the idea the Board had of

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ensuring the establishment which they fostered, being one beneficial to the manufacturers themselves, that they themselves should give the whole sum, and therefore they declined giving it, and that school has accordingly fallen.

1115. Then the contributions from the manufacturers fell so low, that the Board would not contribute their proportion?—Yes.

1116. But if the manufacturers found it advantageous, why did they discontinue their contributions?—They found it advantageous, but the whole body of them were disinclined to contribute to it. There were two or three who continued to contribute to the last, but they found 50*l.* a year was more than they were disposed to give. The master could not undertake it under 100*l.*, and the Board was not inclined to give above 50*l.*, which they originally proposed.

1117. Has any school been substituted for that of Dumfermline?—None.

1118. Not by the inhabitants themselves?—No.

1119. Have there been any schools established at Glasgow, Kilmarnock or Paisley, or anywhere there?—Not that I am aware of.

1120. Do you think they might be established with advantage?—I think with the very greatest advantage.

1121. Has not the shawl trade somewhat decreased at Paisley and that neighbourhood?—The shawl trade rose to a very great height till about a year ago, when considerable failures took place among those engaged in that trade; they attribute those failures to the introduction of the French shawls; whether that is the case or not I cannot say, but they are not now so flourishing as they were years before.

1122. Do you know whether the superiority of the French shawls has resulted in any respect from the superiority of the patterns or of the designs?—The designs of these shawls are almost confined to the Indian patterns; but I believe it is the general opinion, that the French have exceeded even in that respect the English in their patterns, because they have turned their attention to it in a more efficient manner. There is a school at this moment in Paris, where about seventy pupils are instructed expressly in that particular branch of shawl patterns, taught by a person who has written a pamphlet on the subject; and I believe the price of their shawls is under that of this country.

1123. There is no school at Paisley then, is there, connected with the shawl trade?—I am not aware that there is.

1124. Can you tell whether the Mechanics' Institution there give any instructions of the kind?—I am not aware; but the Board of Trustees being aware of the deficiency in that respect, has now sent an exceeding clever artist to Paris, for the purpose of gaining information upon that subject, whom they mean to introduce to the Academy at Edinburgh, and to establish a class for that especial purpose, not for teaching shawl patterns alone, but patterns in general connected with manufactures.

1125. You have stated that it would be an advantage to have branch academies established in the different manufacturing towns in Scotland?—So far as my judgment goes.

1126. What do you think would be the best footing for establishing those?—It appears to me that the best footing to establish those would be to have a system of instruction; a central establishment upon a regular system, which should not be deviated from in any respect; I have not any doubt that in a very short time a number of students would be raised in that central establishment, who might then be sent to the different parts of the country where they might be required, and establish branches in communication with the central establishment, and under the same regulations and the same superintendence.

1127. You would have a central school?—Yes.

1128. That at the same time would serve not only as a school for instruction, but also a kind of *haut ton* for the most recent improvements in all the different combinations of art connected with manufacture?—Yes; I should be disposed to extend it pretty far in that respect, particularly to make it an establishment of different classes. One of the great defects in the mode of instruction in this country is, that the first branch of art, namely the fundamental one, is that which in this country is neglected; that is what is called drawing from the round; it is, in fact, the rudiments of design, the most indispensable, although the most neglected; except the Royal Academy and that academy of the Board

Board of Trustees, I am not aware any other teacher of drawing does really adhere to that system which I know in French academies to be the only system that is taught, because they conceive, and it has been the opinion, I believe, of artists for many generations, as well as the old masters, that that is the only species of study which is requisite to form an artist. If he has once acquired a knowledge of drawing from the round, or drawing from objects of beautiful outline, and containing means of light and shade, that he is enabled then to turn his talent to any of the branches that he may require without any further instruction. In this country we seem to take a secondary part of it; to take instruction in a more advanced part, and neglect the rudimental part.

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1129. And, in fact, is it not true that in correctness of drawing the human figure, and in the knowledge of proportions, we are very deficient?—Very much so in general; and on that account I would make it a rule of that establishment, that the first class should be that one in which instruction is given in chalk drawing on a large scale from the round, having a series of second classes where the different branches connected with the useful arts were taught, which covers very many; architecture and all other branches connected with the useful arts, ornamenting, decorative, house-painters, and so on.

1130. And in an establishment of that kind you would not only make the fundamental principle (correctness of design) the object, but also what may be termed the perspective in botany, and those things which are connected with certain sciences which may be called positive parts of art?—Yes; and it appears to me a very little instruction, perhaps a few lectures, on this, as far as it is applicable to the useful arts, would be sufficient; that is, on anatomy, chemistry, optics, with reference to colours, and botany. It appears to me there is a very great defect in general in our patterns, in botanical accuracy, where flowers are introduced; the foreign pattern-drawers are uniformly correct; our pattern-drawers very seldom so.

1131. Would you sub-divide your institution in another way?—Yes; I would have a third class for the higher branches and for the purpose of artists; but that confined alone to men whose object in life was to be artists.

1132. But in such an institution as that, would you not have a certain subdivision of instruction, so that pupils coming there, and wishing to devote themselves to the study of casting in bronze or in iron, or studying modelling silver, or turning themselves towards pattern-drawing on cotton or on silk fabrics, might have the means, after a certain time, of turning their undivided attention to any particular branch of that kind?—Yes, comprehending the requisite acquaintance with the manufacture itself.

1133. So that they might go out from the institution, having chosen that division of the subject most suited to their capabilities; they might go out as manufacturing artists, to accomplish the particular object which they felt themselves most particularly qualified for?—That is my view; and the purpose I should have in dividing it into classes would be this, to in fact repress an error which those academies are exceedingly liable to fall into, and which the academy of the Board of Trustees in Scotland has already fallen into; that is, of neglecting those parts of the study which apply to the useful arts, and dedicating their attention alone to the higher branches; in fact, making all the pupils study as artists, and not as men to pursue useful branches of occupation.

1134. In fact, is it not true that it is an exceedingly dangerous thing to pursue, in such institutions, those portions of art which may be said to be connected with individual taste or individual genius, since the tendency of so pursuing them must be to neglect those portions of art which are positive and true, and founded upon unvarying principles of art?—Yes.

1135. How would you propose to prevent the tendency that you have described?—I consider that the division into classes might produce that effect, because, if the first class is imperative that no pupil could enter the academy without going through a course of that first class, then he would be enabled to turn his talent to any branch of design he might choose; he may then quit the academy. If he chooses to follow out the pursuit to the highest branches by the recommendation of the master, he may be permitted to do so; but it has been experienced in those academies in Scotland, that many pupils who come there with a view towards the useful arts have quitted it and become artists themselves.

1136. And do you think that that has gone too far?—I think a great deal too far.

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1137. And do you think that the sub-division into classes would be sufficient to correct that?—With precise rules on the subject, which should not be deviated from either by the master or the pupil.

1138. What do you reckon would be the expense of such subordinate drawing-schools, and how might it be defrayed?—It appears that the expense of that academy in Edinburgh, where forty pupils are taught, is exceedingly moderate; the master receives 150*l.* a year, and there is an officer receiving 50*l.* a year; and with taxes and lighting and fire, and so on, there are some other expenses, but of no great importance, and that is the whole amount of it.

1139. Supposing subordinate schools were established at Glasgow, Paisley, Kilmarnock, and other manufacturing towns in Scotland, what expense do you reckon they would be attended with?—I should conceive that a sufficient master would be found at 100*l.* a year, to carry on the establishment.

1140. Might it do for a master at certain times to make circuits through the manufacturing districts, and give instructions for three months, or some such period?—I rather doubt that, drawing requires a little time.

1141. You think it would require a continuous master?—Yes; although it does not require very great labour on the part of the master, it still requires a certain degree of superintendence, that he sees what the pupils are doing; but it appears to me, the more numerous an academy is, the more advantage the pupil derives from it, because he improves by what he sees his neighbours doing; it does not require much labour on the part of the master, but it requires a person to be able to correct where errors occur. In that school of forty pupils I have not any doubt that at any period six or eight might be drawn from it perfectly capable of teaching the art of design.

1142. Then you think instruction should be local, or fixed in certain portions of Scotland?—It appears to me so.

1143. Do not you think it very desirable, on the supposition that these establishments were formed and connected so with the mother establishment in Edinburgh, that publicity should be an essential ingredient of all their proceedings, and the state of the school, the number of pupils, and accounts of the funds should be annually laid before Parliament?—Clearly I think that would be attended with the greatest possible advantage; it would interest the public on the subject, and the interest of the public is very much wanted.

1144. Are there reports annually made by the Board?—Reports are made to The King; that is to say, to the Treasury. They are not made to Parliament at present, but they might easily be extended to Parliament.

1145. Has any thing been done for pattern-drawing in Scotland by the Board of Trustees?—The Board established prizes for pattern-drawing in their academy, and a good many very creditable specimens have been, within two or three years, produced; but there is one deficiency there, which shows the necessity of teaching for that matter, which is this; that many of those patterns that were exceedingly beautiful, were not altogether adapted to the operative part of the manufacture; the persons were not conversant with looms, not conversant with manufactures in fact, and therefore they require the means to be provided of having recourse to a master, who can instruct them in the working of the fabric, whatever it may be, to which their pattern has been employed.

1146. In fact there may be said to be a peculiar intermediate branch between the original design and the invention of that design in the manufacture, which should have separate instruction of itself?—Yes; but it does not appear to me that it is necessary to be an intermediate branch, because the artist may himself be instructed in that matter.

1147. In France the workmen is more an artist than in this country?—The system in France is very different from this country, because in France the artists of the first eminence employ their time, and make it the most profitable part of their employment in pattern drawing, and they are paid a very high price by the manufacturers. There is a legislative protection to their work, which in this country we have not, and yet it is of great importance; so that for a year (I believe that is the period) both the manufacturer and the artist is quite sure of his pattern not been pirated. It appears to me, that some legislative interference in that matter would be almost necessary to go hand in hand with any establishment for encouraging the art of design amongst the middle class of society in this country, that they may be protected in the production of their genius; otherwise neither the manufacturer can afford to risk the loss of the
pattern,

pattern, or to pay a large sum for the pattern which he may lose, nor can the artist risk it. *James Skene, Esq.*

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1148. And would it not be desirable to draw certain distinctions in the degree of protection to be given; some articles requiring one period of protection and others a shorter period?—I believe that is the system in France.

1149. And is it not also desirable that there should be a tribunal, before which a speedy and a very cheap remedy should be given in cases of piracy of patterns?—I am not quite conversant with the French system; I do not know how it is administered; I know that it exists, and answers its purpose.

1150. But on general principles, would it not be exceedingly desirable that a speedy and cheap remedy should be given to the inventor of a design?—Clearly; and that should be perfectly cheap; a small sum to be paid for the right of proprietorship.

1151. Not only would you have an adequate tribunal, but you must also have some satisfactory mode of identifying the design?—Yes.

1152. Have you turned your attention to the best means of doing that, by registration, or by mark, or any other means?—I have thought on the subject; I am not altogether prepared to give a specific answer to that question at present, because it is one requiring some consideration; but I do not see any difficulty in devising the means of doing it.

1153. You have not turned your attention to the propriety of establishing any system, local or central, or a combination of both, for the registration of such original designs?—I have thought on that subject also; I think if any thing of the kind is done by Government, of extending the copyright law to those smaller periods, that it would require to have means of registration in the different portions of the United Kingdom, at all events in the metropolises.

1154. Has any thing been done to improve the knowledge of colours; do you think those engaged in manufactures in Scotland require improvement in that respect?—It appears to me that one thing in which the British manufacturer is most deficient is that of a knowledge of colours; at present, as far as my acquaintance with manufacturers goes, I believe they copy entirely their patterns from France; in doing so, if they introduce any alteration into them they often spoil them; and it is a matter which is not a very difficult one to obtain a knowledge of, the theory of colour; but it is one which appears to me a very singular circumstance that it is not sufficiently attended to, because we know quite well that any deviation from the regular established and fixed rules of harmony of colours, produces the same effect to the eye as any deviation in music from the harmony of notes. It produces an equally bad effect; and in placing our manufactures or fancy goods along with French fancy goods, it has often struck me as a remarkable circumstance to see how very little those rules which are exceedingly simple, are attended to in the English copies. That was my reason for suggesting a lecture on that part of the subject, on optics, in fact, on colours, at those schools; for the rules are simple, but quite necessary to be known to any person who has occasion to place colours in juxtaposition.

1155. Are the French dyes superior to ours?—They seem to me to be very much superior.

1156. In brilliancy or permanency, or both?—In brilliancy; as to permanency, they have two species of them, permanent colours, and colours not permanent. The one is sold at a much less price than the other; and I believe a great deal of their goods which are exported, are not permanent in colour. The Swiss are also very superior in point of dying.

1157. Do you think the Board of Trustees would be able, with their present funds and means, to establish such schools in the manufacturing districts of Scotland?—The funds of the Board have been very much reduced this last year; they are now exceedingly small, but they are at present engaged in measures for the extension of that very object, because it appeared to the members of the Board that that was the most essential requisite for the improvement of our manufactures, because it is obvious to every one that in point of excellency of workmanship the British manufacturers have risen to the highest pitch; it is only in the taste of design in which they are deficient; therefore the Board of Trustees have particularly directed their attention to that subject, as their

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funds have been so much reduced that they do not see they have the means of doing much else.

1158. Do you think it probable that something will be done by the Board of Trustees in the course of a few months?—In the course of this ensuing winter I expect that a good deal will be done on the subject.

1159. Would it not be very desirable to connect institutions of this kind directly or indirectly with botanic gardens, so that the pupils might have the means of studying flowers and acquiring a correct knowledge of natural flowers?—Yes; I know that the French pattern-drawers have the flowers before them. I believe, in this country, when they do make patterns, which is not very often, they take any book of travels containing flowers, which may or may not be correct; but I know the French artists copy from the flower itself, and that, being in the hands of skilful persons, it is always botanically correct.

1160. Might it not be desirable, if it were possible, to create some connexion between such institutions and botanical gardens?—I think it decidedly of importance.

1161. Has that ever been proposed?—No, I never heard of its being proposed.

1162. How many lectures on botany do you think would be necessary for artizans?—I cannot say exactly the number, but I should think very few; it depends on the person giving the lectures; the subject may be concentrated; all that is requisite for the useful arts may be concentrated so as to be delivered in a very few lectures.

1163. Should you think, generally speaking, that there would be any objection on the part of botanic garden institutions to allow such connexion to exist between institutions connected with arts and botanic gardens?—I should think not, as far as Scotland is concerned; the botanic garden is in a manner under the control of the Board of Trustees, who of course might, if it were requisite, insist upon that.

1164. Might it not be possible to connect institutions of this kind, not only with botanic gardens, but also, to a certain degree, with institutions in surgery; for instance, anatomy and other branches; do not you think it would be desirable, if it were possible, to unite institutions of this kind with other institutions connected more particularly with science and art?—I can have no doubt as to the beneficial effect likely to result from it; how it might be brought about, I am not quite aware, except by employing persons; there are only professors; I am perfectly persuaded of the advantage that would arise from it.

1165. Do you think, on the whole, that there has been an improvement of late years in Scotland, both in patterns and in dyeing?—Yes; I think the improvement in matters of taste in general has been very remarkable in Scotland within a few years, and in dyes there has been a very great improvement; since the Board of Trustees have given premiums for that special purpose, there has been a very conspicuous improvement. In patterns the improvement has also been obvious, but not so very great as yet, because there is no instruction given in it; the young men who present these specimens of drawing are left to themselves, and they frequently go wrong in many particulars; it appears to me there is a great deficiency in the want of instruction.

1166. Are any lectures given on that subject?—None.

1167. Would you state what is the extent of the prizes given by the Board of Trustees?—The Board of Trustees give 24 *l.* a year to be divided into prizes for the young men. There are six prizes for ornamental drawings, and six prizes for drawings from the round. The young men produce the first and the last of their performances during the season, in order that the Board may be able to compare their progress; and these are kept in the possession of the Board, not returned to the young men. They are also exhibited to the public.

1168. Would you state what prizes are given by the Board of Trustees for improving manufacturers' patterns?—These are very numerous and vary from year to year, according as the state of manufactures and the state of the demand for manufactures seem to require, also according as it appears to the Board that there are particular branches of manufacture which might be conveniently and advantageously introduced into the country; therefore the premiums which they have offered have varied from year to year. Their principle is, that they shall not continue to give premiums for a longer period for the same purpose than what is quite sufficient to introduce it; when once it is introduced they suspend the

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the premium, because they consider that if it cannot maintain itself after that it is not worth encouraging.

1169. Will you state to the Committee for what subject of arts they have chiefly been given?—Formerly there were a great many premiums given for the purpose of the linen manufacture; these have now been suspended. There are many premiums given for the woollen manufacture; for all the branches of that manufacture. Within these two or three years the Board have particularly turned their attention to matters connected with woollen manufactures, to the branch of carpet manufacture; and they have been the means of very much extending that branch in Scotland by the introduction of three or four new descriptions in the branches of manufacture which never were known in the country before, never practised in Scotland at least, and which have been most successfully introduced, and are now rising into great reputation. They have also turned their attention particularly to the subject of the shawl manufacture; a number of their premiums were dedicated to the shawl manufacturers, and amongst others, being aware of the disadvantage which the shawl manufacturers were exposed to from drawing the yarn used in that manufacture from France, and from France alone, because it was only there where it could be spun, the Board of Trustees offered a high premium for the introduction of the art, and have succeeded in introducing it; and it is now established in Glasgow and Leeds to an extent which I believe now supplies the market as quickly as the French agents did, who do not come now to this country for that purpose.

1170. What was the amount of the premium?—The amount of the premium was 300*l.*; it was the largest premium which the Board ever offered for any subject, and they consider they have done a very great benefit to the country in having succeeded in that scheme.

1171. What is the nature of the improvement that has been introduced in carpet manufacture?—They have introduced the system of making carpets in imitation of Turkey carpets, because they are made of coarse wool, which is more suitable. Their view was the consumption of Scotch wool, which is coarse wool compared with the wool of England, Saxony and other countries; the view of the Board was to extend the market for the Scotch wool, and therefore they introduced the manufacture of Turkey carpets, which has been exceedingly successful, and has very much increased the consumption of that staple of Scotland. They then extended it to the Persian carpet, which is a different fabric also, and that has also been successful; there are a great many looms now employed solely upon these branches. I cannot altogether say, but I believe the carpet manufacture has very much increased in consequence of the introduction of all those different branches. They introduced also the tapestry mode of making carpets in imitation of French carpets; they also introduced the making of carpets from cow-hair, which is an article that formerly was not used in any shape but in that of mixing lime; in fact it was of no use.

1172. When was that introduced?—That has been introduced two years; the premium was offered about three years ago; the yarn was spun generally in the gaols and correction-houses, and those sort of places, by the people who were there, and carpets have been produced of exceedingly good workmanship, and very useful for many purposes, particularly for shops and for lobbies, and purposes of that kind. It is a coarse manufacture, but a very useful one.

1173. Is it peculiar to Scotland?—Altogether peculiar to Scotland; the idea, in fact, occurred to myself; I had seen the use of cow-hair in making rugs and things of that kind in Flanders; and I suggested that improvement, and it has been adopted.

1174. But does not this improvement rather apply to the texture than the design?—The texture entirely; the design is that of the Turkey and Persian carpets, but that has improved the art of design a great deal, because being a new subject, the artist has bestowed a good deal of attention on the subject.

1175. What is the difference between the French and Scotch designs for carpets?—The French design is what is called tapestry carpets, which has also been introduced into Scotland. The Scotch have now imitated that French pattern I think with very considerable success. Those require botanical accuracy above all things, because they generally are groups of flowers thrown down on a dark ground.

1176. And is there not a much greater variety of shades of colour?—Much greater; formerly in the Scotch manufacture, and I believe in the English also, they could not introduce above four colours, except by mixing the threads;

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except by mixing a thread of two different colours. I know that from a circumstance which was mentioned to me by a colour manufacturer in Scotland; he had arrived to the extent of introducing fourteen colours, or tints, which was conceived to be almost impossible; however he was a very ingenious man; his name his Whitock, and he set himself to work and he has very much augmented the number of colours now introduced into patterns. In that respect and in the circumstance of design, and the beauty of execution, I think he stands preeminent.

1177. Has any attempt been made to introduce what the French call velvet carpets?—He has done it, and very successfully, and has obtained a patent for that express carpet. He has sold the right of making that carpet, I believe, to some English house.

1178. Does not that require a wool of much finer texture than what is generally used?—No doubt it does; Scotch wool is quite unfit for it.

1179. What is the wool they use for that, do you know?—I cannot precisely answer that question.

1180. Could you state what might be the prices given for some of the best Turkey carpets made in Scotland lately?—No, I cannot.

1181. Do not you think that a central institution might be of great service, not only in teaching designs and in collecting different designs, but also as a sort of depôt for any thing which might be new in any part of the world, and which might be collected as connected with arts and manufactures?—Certainly.

1182. For instance, the subject you just mentioned with regard to the wool, the premium given by your institution for the wool, which they could not have originally procured, but which they now procure from France; might it not be the object of such a central institution to acquire from all parts information of that kind, and to make their establishment a kind of depôt for all such information?—Yes, I think so.

1183. For instance, there is a mixture of gold which the Chinese often have to work in japan trays, and which we do not know of; it might be very advisable for such an institution, whether it was in London or Edinburgh, or Dublin, to make it one of its objects to collect such articles as those?—I have always been desirous for some years back to introduce something of that kind into the establishment of the Board of Trustees, but the diminishing of the funds entirely put an end to the idea. I had made some progress in preparing for an establishment such as the Committee has suggested.

1184. And in any Report that should be laid before Parliament annually, the novelties of that kind introduced, and the activity therefore provided on the part of the institution, should be specifically mentioned in the Report to Parliament; any new thing of that kind in which they had extended the means of improving our arts in material as well as in design, might also be mentioned annually, as it would give a stimulus to the activity of the institution, mentioning that in the Report to Parliament?—I think it would be attended with great advantage, because it would promulgate the existence of the thing, which otherwise is not known. In case I may have been misunderstood in what I said with regard to the wool which the Board introduced as referring to the shawl manufacture; it was not the wool, which is the Thibet or Cashmere wool, which is in fact imported into this country, exported from here into France, there spun and re-imported into Great Britain; it was the art of spinning merely, which is a different mode of spinning, that the Board introduced.

1185. Where is it spun in this country?—In Glasgow and Leeds. It is a patent manufacture, and the patentee is in Glasgow; he has disposed of the right of spinning to a house in Leeds.

1186. Do not they spin that in France?—In France they do. This is the French mode of spinning, and the French supplied our manufacturers entirely with that article; now, our manufactures are supplied from home.

1187. Do you mean the wool of Thibet?—The Thibet wool; the Cashmere wool. As connected with the subject of spinning Cashmere wool, it may be worth while to mention that the same system of spinning is applicable to all the finer wools, the Merino wools and all the finer wools; and has by this establishment recently introduced in Glasgow, been extended to all those fine wools; they not only spin those wools, but they begin to manufacture the finer fabrics for ladies' dresses, which were formerly imported from France alone; they now manufacture them in Glasgow in consequence of having obtained the mode of spinning the yarn.

1188. How far does the Royal Institution contribute to the improvement of the

the arts in Scotland?—The Royal Institution is now connected with the Board of Trustees, in consequence of an arrangement which took place about four years ago. Therefore the Board of Trustees have obtained access for their pupils to the library, containing works on the fine arts, and every thing connected with that subject; they also have the privilege, for the pupils of the academy, of attending their gallery of pictures, and copying pictures there, and studying as they choose.

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1189. Would you state what is the collection that the Royal Institution have of pictures, of casts, of engravings, and of books?—The Royal Institution have no casts; it is merely confined to pictures; it is a private institution supported by private subscription, and they have expended the whole of their funds in the purchase of the pictures of the old masters, of a collection, not a very large one, but an exceedingly good one, of paintings, which is now open to the pupils of the academy of the Board of Trustees. The gallery of casts consists of about one hundred excellent casts of the finest works of antiquity; they have also the Elgin Marbles, and have received a number of presents and legacies of different works of the same character. They obtained the originals from Lord Elgin; a great many of the casts which he had taken at Greece of different buildings, which are now in the collection of the Board of Trustees.

1190. Are these galleries open to the public?—They are open to the public; to the artists always; to the public on certain days, but always to the artists, and always to the pupils of the academy at all times.

1191. How many of such open galleries have you in Edinburgh, galleries of art?—Only these two, the institution and the academy of the Board of Trustees; there is also the Scotch Academy, an association formed by the artists themselves, not yet a chartered society; and they have annual exhibitions of their own pictures.

1192. What open galleries or collections of works of art have you in Scotland open to the public?—There is one at Glasgow; I am not aware of any other but that and the one in Edinburgh.

1193. Do not you think it very desirable indeed that such institutions should be formed?—I think most desirable.

1194. And that they should also be entirely open to the public as much as possible?—Clearly.

1195. Do not you think it very desirable that such institutions should not only be open in the middle of the day, when the rich can devote their time to the inspection of works of art, but as much as possible at early hours of the morning, and also the evening, when the labouring population may wish to go there, not only with a view to recreation, but also to instruction in their own art, as far as they are connected with art?—The only difficulty that occurs to me with regard to that is the want of light.

1196. But in the summer?—In the summer, certainly.

1197. And as far as it might be practicable, in the winter too?—It would entail some additional expense, but I do not see why that should be an obstacle to it. There would be some additional expense for attendance. To the great facilities that occur abroad of exhibition of works of art, I attribute very much the proficiency that exists in foreign countries in the knowledge of design, and in the higher scale of taste that exists among the middling classes of society abroad, compared to what it is in this country, for here it seems to be confined to the higher class alone almost.

1198. Have you any exhibitions in Scotland for the exhibition of works of art, such as ingenious patterns and manufactures, or ingenious specimens of weaving?—That intention was contemplated, but never has been put in practice.

1199. Was it from any disinclination on the part of the artizans to send works to such exhibition that that intention was not carried into practice?—Not precisely; nevertheless I understand that there does exist an indisposition on the part of persons who have made inventions or improvements to exhibit them, from the circumstance that they are aware that they have no protection; that their invention and the property of their improvement is not protected.

1200. There is an exhibition of carpets and silks?—Yes, an exhibition of the competition goods for the prizes given by the Board of Trustees.

1201. Would you describe that?—The Board of Trustees for the encouragement of the manufactures of Scotland offer annually a series of premiums for

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improvements in different manufactures, also for inventions, should any take place. Those are annually exhibited to the public, and judges are appointed from among the manufacturers, who examine the goods and award the premiums. The circumstance that induces the manufacturers to attend very much to that, is that by obtaining the premium for their manufacture, they obtain the means of publishing, very much to their own advantage, the species of trade that they carry on; otherwise the premium is a very small one, and scarcely worth the while of a manufacturer to work for it.

1202. Have these exhibitions generally tended to improve the arts in Scotland?—They appear to me to have done a very great deal of good, so much so that within these five years they have progressively increased, so much that five years ago a very small apartment contained the whole; now the large picture rooms of the Royal Institution are not sufficient to contain the goods.

1203. Have you turned your attention to the French triennial exhibition of works and manufactures?—The French Exposition? yes, I have turned my attention a good deal to that; and a paper of mine, communicated in one of the printed reports of the Board on that subject, gives a particular account of that establishment in France, and of the advantages derived from it.—[See Appendix, No. 1.]

1204. Do you think it is advantageous?—I think it is highly advantageous. Where it enjoys a very great advantage over any attempt in this country, is that the improvements of the year, and the inventions of the year, are by the French manufacturers expressly reserved for that exhibition, because they know that they are safe in producing their new design, whatever it may be.

1205. Are the specimens of manufacture exhibited in the institution taken away at once, or left there after they receive the premiums?—The period is but a very short one that the exhibition lasts, not above three weeks, and as soon as the premiums have been awarded by those appointed judges, the exhibition is open to the public, with the prices stated on each article, and the goods are sold.

1206. For what period?—For about a fortnight; the first week is taken up in examining for the premiums, and then there is a fortnight for the public.

1207. Would it not have a better effect on public taste if they were left for a longer period in the institution?—I have not any doubt of it. There is a reason which has hitherto prevented the Board of Trustees doing so; they are desirous of doing so, but they have been prevented doing so, because these premium goods are generally bought by the trade in Edinburgh, and they are anxious to get them into their shops and exhibit them as fast as possible.

1208. Does the determination of the judges always give satisfaction?—Generally; I have never heard of any dissatisfaction in consequence of it.

1209. Do they extend to patterns as well?—Yes.

1210. Not only to the materials, but to the patterns?—There are premiums for patterns of all descriptions, and for the manufactures also.

1211. And also for inventions?—And for inventions.

1212. And machinery?—There have been premiums offered for machinery; but there has not yet been any produced, because the inventor of the machinery is afraid to produce it.

1213. Could you ever trace the talent that has gained the premiums to the institution at which that talent has been instructed?—Almost always.

1214. Are you aware whether the manufacturing artists from Scotland have been induced to go to foreign countries to study?—I am not aware that they have, because they have not as yet considered the pattern-drawing as a trade; in fact, it is considered a trade, and a very important one, abroad; but it is not yet taken up by the Scotch artists.

1215. They have not gone to Bruges or different places on the Continent, where they receive cheaper and more extended instruction in art?—I am not aware of their doing so.

1216. Or have any foreign artists come to settle as designers of manufacturers in Scotland?—No, I am not aware of any.

John B. Papworth, Esquire, called in; and Examined.

*J. B. Papworth,
Esq.*

1217. WHAT are you?—An architect.

1218. Where do you reside?—At 10, Caroline-street, Bedford-square.

1219. You are very familiar with the interior decoration of houses, are you not?—Quite so.

1220. That

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1220. That is what you have principally devoted your attention to?—No; to architecture generally; and having a very great love for the art of ornamental design, I have paid very considerable attention to it.

1221. Do you consider that sufficient encouragement is given in this country to the art of general design?—No.

1222. What distinction would you draw with regard to the encouragement which is given to general design and the encouragement which is given specially to painting, sculpture and architecture?—Painting, sculpture and architecture have a certain quantity of employment, for which they receive payment for its execution. Another branch of art, that is, ornamental design, is very little encouraged, because the manufacturer (not being protected from piracy), if he pays an artist a large sum for that which he performs, another person may very soon get possession of the design, and use it for himself, and therefore the first manufacturer gets little or no remuneration.

1223. Is the manufacturing artist well instructed in this country?—No; and I know of no public school of instruction for him in London.

1224. Is he as well instructed as on some parts of the Continent?—He is not. On some parts of the Continent he is well and publicly instructed; the manufacturers in the working of gold and silver, and the ornamental works which relate to the embellishment and decoration of houses, have frequently been obliged to apply either to sculptors, painters or architects, and have been so furnished with designs, for which they have paid considerable prices, because they have not been able to find artists in general designs that could answer their purpose.

1225. Then you mean that the manufacturer is obliged to have recourse to a higher scale of artist than he need have recourse to if proper instruction were given?—Precisely so.

1226. Is art, so applicable to interior decorations and to manufactures, cheaper in France than in those continental nations which have made this their object, than it is in England?—Considerably cheaper on the Continent.

1227. Then you consider the defects in art, as applied to manufactures, principally derived from two sources, the want of instruction and the want of protection?—I think chiefly the want of protection, because there are a great number of clever artists in this country, sculptors, for instance, who would occasionally model a tablet, a frieze or some other work of art, would cast and sell the work in such numbers as would produce remuneration to the artist; but if he were now to let one such cast pass out of his hands, it would be sold probably about the streets in a week or a fortnight for 2s. or 3s. He is not protected sufficiently to allow him repayment for the work that he performs with so much care and study. In this country, if an architect wanted to find a modern vase, a modern tablet or a modern frieze of very fine art, he might therefore seek it in vain.

1228. Are the producers of these designs better protected abroad?—I understand they are.

1229. Have you ever devoted your attention to the best means of protecting inventions of this kind?—I have; a protecting law, as of copyright, would perhaps be the best means; but it is important that there should be a place with the means to teach ornamental art; a place of instruction that would also display examples of the very finest works, ancient and modern.

1230. Is it not the case that nearly all the good models are to be found in foreign countries?—Of modern art, yes.

1231. Then is it not the case that an architect or an artist has not sufficient time to devote to acquiring a knowledge of that art before he finds it necessary to turn his time to account in the production of original works?—Yes; a student of course must first make himself capable to produce works of fine art, and much time and instruction is essential to this attainment. Then if he were encouraged to proceed by knowing he should be paid for that which he published, he would employ his talent, or it would find employment; but feeling he shall not be remunerated because ornamental art is not adequately protected, he does not sufficiently cultivate it, and the public loses the benefit of his talents.

1232. But is it not the case that the time and trouble necessary to acquire a thorough knowledge of the art, is more than professional men have the opportunity of devoting?—It is certainly; if they had the same means in this

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country that they have abroad, it would be a saving of much time ; I am alluding to the art of ornamental design, not to painting, sculpture or architecture.

1233. What are those branches of manufacture which create the chief demand for the assistance of artists?—They are the gold and silversmiths, manufacturers of ornamental furniture, of works in metal, carving, ornamental glass, in china, and in house decoration generally.

1234. How do these branches of manufacture obtain assistance from artists connected with manufacture, or do they go beyond that for assistance?—They frequently go beyond it; for superior designs they go for assistance to painters, sculptors and architects, but at a cost of expense to the manufacturer that has considerably lessened his demand upon those artists, and there have been but few others on whom he could rely.

1235. Do you consider that our designs in gold and silver are very much improved of late?—I think they are very considerably improved within the last 25 years, and from the employment of painters, sculptors and architects.

1236. Are we superior, equal or inferior to any foreign country, in our designs in gold and silver?—I think our classic designs may be considered equal to many of theirs, but we have not many eminent chasers in this country, and our castings in metal are therefore too gross in many instances.

1237. Do the silversmiths abroad resort for designs to artists of as great eminence, as they are in the habit of resorting to in this country?—I am not sure of that, but they do resort to some artists of considerable eminence abroad who have assisted the manufacturers occasionally ; but I believe that has been more from works in art being executed immediately from their designs for their employers, and not from being employed by the manufacturer to design it for them ; sometimes, however, the employer is the manufacturer.

1238-9. Now the manufacturers of ornamental furniture, to whom do they have recourse for designs?—They generally employ a person who has been a carver, or some young man who has shown a talent for drawing in their way, and he is led on, bit by bit, without any public school of instruction, to put together certain ornamental parts, and thence to make new matters.

1240. Are they obliged to pay very high for designs also?—Yes ; if they go to the higher branches of art for them.

1241. Do you know whether the French manufacturers of ornamental furniture pay high for designs?—I think not, when they go to professional designers for them.

1242. Therefore there is more art in ornamental furniture manufactured in France, than England?—Yes ; a great deal.

1243. In fact art comes down more into the manufacturing workshop in France than it does in England?—Considerably more ; they seem to have an art of design in employment, perfectly in union with their manufactures ; in fact, art dwells with manufacture more in France than in England.

1244. Do you make the same observation with regard to ornamental glass?—That is employed in but very small quantity ; the changes are few, but in this country some changes have been made, and very important ones, by the assistance of the higher professors of art.

1245. Now with regard to china and house decoration generally, do you also extend the observation you made as to the want of art being combined with manufacture, and forming a portion of it, to china and to the decoration of houses?—To both.

1246. Do you consider that if the knowledge of art were more extended into the regions of manufacture, such as you have mentioned, that the demand would much increase for the articles which they designed?—I should think it would considerably.

1247. And do you generally think that extending and cheapening art, would extend also the demand for art?—I have no doubt of it ; and with regard to the prior question, I have reason to believe that our want of good designers and sufficient workmen, capable of executing the several ornamental works at a moderate expense, are true causes why we get a great deal of that very old matter of furniture from abroad, which arrives in ship-loads, and which is adopted instead of new furniture, much to the disadvantage of our designers and our workmen.

1248. There is a class of artists called pattern-drawers, employed by calico-printers,

printers, paper-stainers, silk-manufacturers, carpet-makers, and many others, is there not?—There is.

1249. Do these persons show much originality of design and correctness of drawing in their patterns?—They do not.

1250. Upon what resources do they depend for the articles introduced by them?—They generally depend on the articles that are introduced into England from foreign markets, but this supply, readily obtained by manufacturers, sometimes supersedes artist-like employment altogether.

1251. Then the supply of these designs from foreign markets is the effect of the want of instruction in these pattern-drawers themselves?—Exactly so; if the Committee will allow me, I will put it in a shape that will make it rather clearer; I will imagine that a piece of silk is brought over to this country and is seen and looked at; the merchant approves and sends it to the manufacturer; the consequence of which is there is, no employment for a draughtsman or a designer for that piece of work, and the articles that are so introduced pass to almost every manufacturer, and shut out the employment of original designers.

1252. Have you had an opportunity of knowing what assistance the manufacturers principally want for their purposes; have you heard them complain of the want of any particular assistance they require?—They want, in every case that I have found, a protective law; if they had that, they would not need to despair.

1253. Do they require any additional information in design?—They are very desirous of having it; manufacturers lament exceedingly the want of adequate assistance for their purposes in design; judgment, accuracy of drawing, and in knowledge of and arrangement of colour; and they would readily pay, even for the best assistance, if the use of that which they pay for, was by law so protected to themselves, for a reasonable time, that they might have reimbursement; but it has often happened, when a manufacturer paid for a good design, and (as for metal work) had the pattern carved at a considerable expense, intending to have it executed in silver or some other valuable metal, that from the dishonesty of his workmen, another person has forestalled him, by bringing out the same thing in lead or cast iron.

1254. Then piracy in such cases is very common?—Very common; piracy is so common in works of art, even of architectural ornament, that artists will not execute a fine design on their own account, well knowing that as soon as they sell one plaster cast of it, they have no further hope of benefit, and thence the absence of original matter in vases, tablets, foliages, &c. of which England possesses few or none that are worthy of observation.

1255. Have you ever turned your attention to the best mode of accomplishing this protection?—I presume that it would be on the principle of patent-right, allowing every manufacturer a patent-right for a reasonable time, in proportion to the nature of the article that he produces.

1256. And then what mode of identifying the article for which the patent was obtained would you pursue?—It strikes me that it would be proper that certain competent judges should be established for the purpose of ascertaining the points of fact whether it is piracy, or whether it is not; but there are two sorts of piracy; for instance, a sculptor models a bust, with a Roman robe on the shoulders; some one gets possession of this, and publishes it altogether; that is a complete piracy. But another man will remove the robe, and substitute another piece of drapery; he then calls that no piracy; and there have been many injuries done to artists by that and similar circumstances in many branches of the arts, and in engravings particularly.

1257. An invention of that kind is, to a certain extent, protected by Act of Parliament?—Yes, it is protected, as far as it applies to whole piracy; but partial piracy is sometimes followed, and I do not find that that is sufficiently opposed by any present law.

1258. Is not the remedy also given by Parliament an expensive one?—Yes.

1259. And the designers are deterred, in consequence of that expense, from protecting themselves when they otherwise would do?—Very frequently; and in consequence of the expense.

1260. Do you, therefore, consider it essential that protection in a cheaper mode, establishing the right of the original inventor, should be afforded?—I do.

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1261. Would

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1261. Would it not be a hardship, and rather injurious to art, to confine particular combinations of nature to the first person who might happen to have formed them?—I should think it would be so.

1262. Then you do not extend your remarks to the first person who may happen to hit on particular designs?—No, but to the design and work together.

1263. Have you turned your attention to the best mode of identifying the designs for which the copyright has been taken out?—I have not.

1264. What has been the consequence of this absence of protection on the style of manufacture?—The absence of protection has induced manufacturers to seek a style of ornament capable of being executed with facility by workmen unpossessed of theoretical knowledge, and without practical accuracy. This style has been fostered to a great extent, and erroneously termed that of Louis XIV., but which, in fact, is the debased manner of the reign of his successor, in which grotesque varieties are substituted for classic design; and it is admitted that designers and workmen of very mediocre talents are preferred to better artists in this kind of work, for it is little amenable to the criticism of the judicious, and the workmen are usually free from the trammels of artist-like education.

1265. In fact, it is what the French call the style of Louis XV.?—Yes.

1266. Most of the designs passing in this country under the name of Louis XIV. are the mere spurious designs of his successor?—Yes.

1267. But then the Louis XIV. style was very various in his early days?—Yes, the early style of Louis XIV. was a very bold, a very sumptuous and a very grand style; it was adopted with avidity, and there was a great demand for it in his magnificent reign; it thence became debased, even in that reign, by the employment of meaner workmen; but the grand designs of Louis XIV. were essentially different from those of Louis XV.

1268. What does the superior character of the design in the early part of Louis the Fourteenth's reign proceed from?—In the early part of Louis XIV. it seemed as though the Roman style was not sumptuous enough for his purpose, therefore he demanded designs of a more extravagant, a bolder and larger character, and of more sumptuous expression than the Roman style afforded; but the Roman and Italian styles, made more sumptuous, is the style of Louis XIV.—[*The Witness exhibited two small Prints of the different styles.*]

1269. What you call the Roman style, is not that the style of Michael Angelo?—Yes, that and the style from which he studied, but the moment that the grotesque scroll, so common in the works of Louis XV. was introduced, it interrupted the chasteness of the Roman style.

1270. Have not the French lately devoted their attention to a style of art which they call the style of the Renaissance, or the early style which prevailed when the arts again began to dawn in Italy?—I understand they have, but I have seen nothing of it.

1271. Is not the style of what you call the flowing outline capable of being executed by people who have no freedom whatever of hand?—Of the Raphael style, certainly not; but artists of mediocre talents can design and execute the grotesque scroll-work with ease.

1272. And does it not owe its prevalence to the facility of its execution?—It does; it is easier manufactured; it is often manufactured by putting bit and bit together of heterogeneous matter to form a new whole.

1273. That requires neither taste, imagination, nor freedom of hand?—Very little, or none.

1274. Is that what you call the scroll style?—I would term it the grotesque scroll style.

1275. Then should you apprehend that, as this style has so long usurped the place of true art, you would have some difficulty in finding workmen capable of performing ornamental classic works?—I have experienced great difficulty in finding capable workmen for works in the best styles.

1276. Define more exactly what you mean by the classic or pure style of art?—Such works in ornamental art as were executed by the Grecians, Romans and Italians, and which have long been accredited as the offspring of high and cultivated taste, and as practised by Michael Angelo and Collini, as designed by Le Pautre and others, and given in valuable documents by Piranessi; this style is almost lost to this country and to its manufactures.

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1277. Have you ever turned your attention to the best means of reviving, or rather of creating, a more pure style among our artists?—Very recently, within a year or a year and a half, I have, in conjunction with other professional men, been very much concerned in forming an institute of British architects, which has now got into operation. The very views which this Honourable Committee take, had already influenced the members, and who were not aware that this subject was likely to occupy the attention of the House of Commons. In that institution we shall endeavour to improve the art of design from fine examples, getting together a collection of antiques, and offering rewards, not merely for the copying those antiques, but for composing new designs in that spirit.

1278. Is your institution connected with instruction?—We have no school, but we propose to have lectures upon the subject, and I believe it will be very soon established, so that we shall have good modellers for the students, or rather, I should call them, the younger members. They can draw already, we shall have good modellers for the purpose of teaching them how to do works by their own hands, for when they have learned that, we shall find them able to instruct others whom they may employ. I think that result would follow of course, but such means of improvement as may follow the labours of this Committee, I think most likely to assist artists in every way, and the benefits of which will pass through the whole manufactures of the country.

1279. Have you ever turned your attention to the best mode of instruction to be adopted, to the extent or the mode of instruction?—Not particularly to that object perhaps, but drawing in general, and modelling, seem to me to be the two chief accomplishments towards obtaining the end desired; modelling is very important.

1280. In the works which have come under your view of foreign and English artists, do you consider that there is any characteristic difference between them?—Yes, very great in those that relate to the manufacturing arts.

1281. Which do you think superior?—The foreign.

1282. By foreign do you mean French?—I mean French chiefly.

1283. You state generally, you think it very desirable that instruction should be extensively given to manufacturing artists?—I do.

1284. You have not devoted your attention particularly to the mode or nature of instruction?—I have not, further than I have already stated.

1285. Are you also of opinion or not that it would be desirable that they should have galleries of casts, and collections of beautiful specimens of art open to them, as much as it is practicable, at all times, both to the artist and to the pupil?—I think it most desirable, and it also struck me that another means might be of very considerable advantage to artists in ornamental works. If an exhibition was to be created annually or otherwise, as might be considered best, of such works of fine art as gentlemen might please to allow to be exhibited for the benefit of artists, some in London, some in Edinburgh, and some in Dublin, I think it would have great influence on general taste.

1286. But does not that exist in the British Gallery at present?—No; I do not allude to works in painting and sculpture, and the higher departments of art; but I mean an exhibition of vases, casts, bronzes and works of decorative architecture; for one of the events to be feared of an exhibition is, that by those higher departments of art, where human figures are the chief matter, young men might be tempted to leave the intended object to pursue that which is more accredited and honoured, and to the disadvantage of the manufacturing arts.

1287. But do not the public attach greater importance to works of art than they did some years ago?—Yes, very considerably.

1288. As far as the ornamental decoration of houses, both external and internal, are concerned, have our houses improved of late years?—I am not aware that they have, and I think it arises from this circumstance, that ornamental works in houses of the finer and the higher class are omitted, because we have not sufficient nor more able artists to execute them at a moderate expense. In consequence some of the very finest works in this country, in point of proportion and of design, are without the ornaments that belong to the Italian, the Roman and the Grecian style of decoration.

1289. You mentioned that an institute of British architects has been recently established; was it established in consequence of the want of sufficient instruction in other institutions?—No, it was not; it was founded for the purpose of facilitating the acquirement and diffusion of architectural knowledge; for the promotion

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promotion of the different branches of science connected therewith; for establishing an uniformity of practice, and maintaining a high respectability of character in the members of the profession; numbers have joined it. We have had some large donations from gentlemen; and we have thence felt that we could carry it much further, and purpose to foster the art of design as much as we possibly can.

1290. Is not instruction in architectural design afforded by the Royal Academy?—They have schools for drawing the human figure and for painting and also for perspective, but none for ornamental designs.

1291. Are you acquainted with the works of Percier and Fontaine?—Perfectly.

1292. Do not you think that they have contributed very much to spread just ideas of taste in design?—Very considerably; Europe is greatly indebted to those artists.

1293. Does not that afford a proof of what people in quest of just views and capable of carrying them into execution may do towards reforming the art of their day?—Clearly; Percier and Fontaine have been highly useful to the manufacturing arts of their country and elsewhere.

1294. Has not ornamental pottery made some progress in this country?—Some, but very little, on account of their not employing persons who have a good idea and knowledge of elegant form and beautiful proportions.

1295. But is it not one of those branches of art which is most susceptible of improvement, and in which the advantage would be most perceptible if that improvement took place?—It would be very greatly so.

1296. Are the forms in foreign or in British china most accurately drawn?—Foreign; some of the French and German are beautifully designed in form and proportion. In this country works of the best forms are those copied from foreign articles.

1297. Then you would of course apply your more general observation to these particular branches of manufacture, and state it is very desirable for the persons who design for china to be better instructed than they are?—Exactly, and thence obtaining better taste.

1298. What do you consider to be the effect of the brick duty, as far as art in architecture is concerned; the limiting the bricks to a particular size and a particular form?—As the material of which brick and tile is composed is capable of receiving an impressment of mind upon it, and to great extent and variety, I have no doubt that permission to make them in any form would be a great benefit to architectural beauty.

1299. Is it not the case that in Lombardy brick is introduced in combination very nearly as beautiful as any thing that can be made of stone?—I have known it so. There is much of beautiful form and useful work that might be executed if the manufacturers of bricks were allowed to make them of any form they chose; but for general building I am not aware of any forms so good as those now in general use.

1300. And is it not the case that in all countries where brick is used in great quantities except in England, that modification of form does exist?—I believe it has been so from very early times.

1301. Does it not result from that that the limitations to which brick-making is subject in England are a great impediment in the way of development of that description of art?—Clearly.

1302. If it were not for the high duty on plate-glass and the duties paid on glass generally, would not glass have been made a material to exercise art upon more extensively than it has been?—I think it would; one of the great preventions in introducing coloured glass particularly, is, as I am told by the manufacturers, that they may not melt less than a certain large quantity of any one colour; therefore, if it is for small articles that they want it, or for one small article, they are perfectly prevented from using it at all.

1303. And has not the window-tax also, in limiting the number of apertures and restricting their size, had an exceedingly injurious effect?—Exceedingly; and in the proportion and the beauty of buildings altogether, architects find very great difficulty in adapting size and proportions, so as not to infringe upon the limitations prescribed, perhaps when they want very different quantities.

1304. So that in fact a great deal of the poverty and monotony of our buildings in London may be traced to that source?—Yes, a great deal of it.

1305. Is

1305. Is sufficient intelligence in art exhibited in such works as furniture in this country?—I think not, unless designed by the architect himself. If he will not give his attention to it, the taste of the furniture is not good in this country, or not so good as it might be.

1306-7. The taste of the manufacturing designer is too unconstrained by the general principles of art?—I think so.

1308. But does it not fall within the province of the architect to give that attention?—Not always; there are a great number of employers of an architect who would rather go into a cabinet-maker's shop or elsewhere and buy articles than direct him to design them.

1309. But did not those people we have alluded to, Percier and Fontaine, turn their attention very much to interior decoration as well as to exterior and higher branches of art?—They did to both, and such has been the practice in England also.

1310. But in the furniture of houses generally in London, which are left to the mere upholsterer to furnish, is there not a want of knowledge of body and of form and combination and of accuracy?—I think there is, indeed I know there is a great want of clever designers in that as in other departments.

1311. And in fact, as you have already stated, there is a want of closer connexion between art and manufacture than exists?—Certainly there is.

1312. Is there not now, for instance, in the arrangement of drapery, a great want of taste prevailing in this country?—I think there is generally; but we have some well qualified on the subject of drapery.

1313. What is your opinion of the degree of skill that exists in this country in the arrangement of drapery, as contrasted with that of the Continent?—I have seen drapery done by people in England vastly superior to any thing I have seen on the Continent; I think we have often been more successful.

1314. But what should you say generally of the manufacturing artist in drapery?—I should say that we have but few eminent artists who generally design it, but the principal of the house and his local assistants.

1315. In fact, then, it would be only just to the artist that he should have better instruction given him than he has at present?—Clearly.

1316. But do you consider good taste is as generally prevalent in this country as it is abroad?—Certainly not; I think we are very far behind the French in some instances, I am speaking of the manufacturing arts, and not as relating to the higher departments of art.

1317. And therefore you do not attribute the want of taste to the want of talent in any degree, because it exists, where properly encouraged, in the higher branches of art, but you attribute it to a want of instruction generally?—Decidedly; I am satisfied there is innate talent enough in the country to supply all its wants in art.

1318. Do you consider that some knowledge of the principles of art ought to belong to those people who have the superintendence of public works?—Certainly.

1319. Have you any other observation to make to the Committee?—None, except this, that I was present when Mr. Skene gave his evidence, and I agree generally in what he stated.

Lunæ, 24^o die Augusti, 1835.

WILLIAM EWART, ESQUIRE,

IN THE CHAIR.

Messrs. *Philip Barnes* and *Robert Barnes*, called in; and Examined.

1320. To Mr. *P. Barnes*.]—WHAT are you?—An architect, also Fellow of the Linnæan Society.

1321. Where do you reside?—At Norwich.

1322. You are connected with an institution for the promotion of the knowledge of arts among the manufacturers of Norwich, are you not?—I am connected with the Norwich Society of Artists for promoting the knowledge of Drawing, and have been for the last 25 years.

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1323. Will you state how that institution is connected with the manufactures?—The institution itself is not connected with the manufactures, but since the establishment of an academy of art, which is attached to the Norwich Society of Artists, it might be so connected. The institution itself was established in 1803 as a society, and first had a public exhibition of the works of art by the members and their pupils in 1805; which public exhibition continued annually till 1833, when by the death of some of its members, and the withdrawing of others to the Metropolis, and the want of patronage and other causes, over which we had no control, we were obliged to suspend the exhibition for the present from that period. The society itself is the oldest provincial society out of London; and I believe it is the only one that has maintained itself, after struggling with great difficulties. It is supported principally by the exertions of the members themselves.

1324. How long has the other establishment existed?—That has existed about five years: that was in consequence of the corporation of Norwich presenting the Society of Artists with the sum of 100*l.* to purchase a collection of casts, with a view to have it as an open and more public establishment. The society has extended the number of casts, and expended other monies besides that given by the corporation to establish this academy; but the expense of conducting the academy is now sustained by the pupils themselves, at a rate of pretty near 4*l.* a year each.

1325. How many pupils are there?—There are not more than six pupils at this present time, and those are adults; there are no masters.

1326. What instruction is given to them?—The artists themselves attend and give mutual instruction. There are no regular masters.

1327. And are these artists simply artists, or are they artists connected with manufactures?—They are artists only, and drawing masters.

1328. Then what effect has that on the manufactures of Norwich?—Why, at present I am not enabled to say what effect it has had; but it would have an effect if it could be thrown open and made a free school.

1329. Has this institution ever had an effect on the manufactures of Norwich since it was established?—I think in this respect it has, that there are scholars who go now to this place who had not the opportunity before, and who are supported by occasional assistance of friends; for instance, Mr. Walker, a gunsmith, pays for a boy, who otherwise could not attend to take instruction, and a very talented youth he is.

1330. Do any persons who pursue manufactures attend this institution; for instance, do any weavers?—I am not aware of any at this moment.

1331. Then this institution has very little connexion with manufactures?—Very little at present.

1332. Was it established with the view of aiding art among manufacturers?—It was established with the view of extending art generally in Norwich.

1333. But not generally with a view to manufactures?—Not altogether; but we were in hopes it would lead to that.

1334. Would it be of service to the manufacturers there to extend such institutions?—Most assuredly; and Mr. Barwell, the secretary, has been most anxious to extend it for that purpose.

1335. Do you consider that you speak the opinion of the manufacturers themselves, when you say that?—I have no doubt of it.

1336. Do you think the workmen would like to have such institutions?—I am sure of that; and as a proof of it I have a letter sent me by our secretary, Mr. Barwell, from one of the drawers of patterns connected with shawls.

1337. State the substance of what he says in that letter?—He says that his income is too limited to allow of becoming a member of the Drawing Academy, established in this city; and that consequently he is obliged to depend upon his own talent for the production of designs suitable for the manufacturers; that if he could avail himself of attending the institution or the academy, he has no doubt that it would be of considerable service to him in promoting his taste and knowledge in the fine arts and in the art of design; and that he speaks the sentiments of the pattern-drawers generally, who are similarly circumstanced to himself.

1338. Have you any open galleries in Norwich for the exhibition of works of art of ancient masters, or of casts from the antique?—None besides this academy.

1339. What does this academy contain?—General casts from the antique.

1340. You have some casts then of the antique?—Oh yes, a great number.

1341. You

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1341. You have a good collection of casts, have you?—Yes, it is considered to be so.

1342. What do they consist of?—Statues and vases.

1343. Now is that collection open to all the public?—No, it is not.

1344. Is this gallery of casts open to the public?—On application to the secretary persons may see it.

1345. But nobody can walk in at once?—Oh, no; certainly not.

1346. Do not you think it would be better to allow the public to walk in under proper superintendence?—Most unquestionably, and that is an object which the society would be anxious to obtain. The society would open it to the public if it were not for the expense of the superintendence.

1347. Have you any other open exhibition in Norwich besides this?—None, only the annual exhibition.

1348. Do you think good has resulted from this exhibition as far as it has gone?—Undoubtedly, to a very great extent; the artist has improved, and the taste of the pupil also.

EXTRACT from Mr. Roberts' Letter (of the firm of Wilmot & Roberts of Birmingham);
August 3, 1835.

"I have indeed always felt much interest about the Norwich Society of Arts, and great reason have I to do so, for I have ever considered that your society, in better days, gave an impulse to the provincial institutions, and exhibited to the country a display of local talent which left every other similar attempt far behind."

1349. What hours of the day is the gallery open where the casts are?—It is not open at all except on application.

1350. Then can you give any idea of the number of persons who visit this gallery of casts from the antique?—No.

1351. Do you think there are many persons in a day?—Oh no; very few indeed, because we cannot allow of any person being there to attend. If we could have a person in attendance, I have no doubt a great number would visit it.

1352. And there is not a person in attendance because the society cannot afford it?—They cannot afford it.

1353. Do you think that the institution of schools and places of instruction in art would be a great advantage to the manufacturing population of Norwich?—Undoubtedly.

1354. Do you think also that the opening of galleries where they might see the most beautiful works of art, and opening libraries where probably such works might also be exhibited, together with books, would not also be a very great advantage to the manufacturers?—It would, decidedly.

1355. It would call into life a taste for art which is either dormant or does not exist at present?—Yes, and particularly in Norwich, where I think there is a general taste for literature; and that the lower orders of society there would be very much improved in a very short period of time.

1356. Do not you think that the institution of such places of instruction and of such galleries of art would have the effect not only of improving manufactures, but the moral and social conditions of people?—Unquestionably it would to a very great degree.

1357. What branches of manufactures in Norwich will be principally benefited by such institutions?—The fancy fabrics of Norwich, the shawl and silk dresses, and fancy goods generally.

1358. Are we inferior or superior to the French in such fancy patterns now?—The patterns themselves are inferior to the French, decidedly; but I have always understood that the workmanship is far superior.

1359. How do you account for this inferiority on the part of the manufacturers of Norwich to the French in patterns?—From the want of establishments of the kind where they could be properly taught.

1360. Then you think the French are superior?—Undoubtedly, they have better opportunities of learning.

1361. Have you ever known the French system of instruction?—I have been on the Continent, I have visited the Continent several times, and I find they have large establishments there that are open to the public with very trifling expense.

1362. You have not been in France with the especial view of turning your attention to the subject of instruction in art, have you?—No.

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1363. But you have been in some parts of the Continent?—I have visited it merely for pleasure.

1364. But you are not a member of one of the academies on the Continent?—Of Bruges, I am.

1365. Will you state what is the nature of the instruction given in that academy?—The academy at Bruges has different departments in art. There are, I understand, three masters for the first degrees of figure, another for life, one for architecture, one for sculpture and one for painting. The academy is supported by subscriptions, partly from Government, and partly from the town and governors themselves, who have the power to send pupils and recommend students.

1366. Do the students pay anything?—Nothing I believe except a fee of a franc to the servants.

1367. Is there any examination as to capacity of the students for art before they are admitted?—None.

1368. Then is any body allowed, whether he has talent for art or not, to continue to profit by the establishment?—Yes.

1369. Would he not be sent away if he were found incapable?—No, I believe not; my son can tell; he was there.

1370. To Mr. *R. Barnes.*]—Do you happen to know whether that is the case, that they will be sent away if they are found incapable?—They never allow them to go into the higher branches, they do into the lower.

1371. To Mr. *P. Barnes.*]—Are the young men in this school instructed with a view to proficiency in designs connected with manufactures?—I should presume the art generally; the continental feeling is such, that almost every town there has an establishment.

1372. Then this school is generally open, is it?—Yes.

1373. And does it extend a knowledge of the art generally throughout the population of Bruges, do you think?—There are six or seven hundred students, and the population of the town is little more than 20,000.

1374. Do these young men enter the school with the view of becoming manufacturing artists, as well as becoming artists only?—I have no doubt of it.

1375. And have you the means of knowing whether this institution has had a good effect on the manufactures of Bruges?—I have always understood it has.

1376. Do you suppose that such an institution must have an effect upon the capabilities of every manufacturer whose trade is at all connected with design or pattern?—I have no doubt it would be of great advantage.

1377. Do you know at what time the students are instructed in these institutions?—In the evening; every evening in the week excepting Sunday.

1378. What is the reason that they are not taught in the day?—Because the greater portion of them are the poorer class of society, and they have a better opportunity of attending in the evening after the labours of the day.

1379. And do they attend to the number of six or seven hundred, do you suppose, in the evening?—I believe so.

1380. Is the establishment large enough for that?—The establishment is quite large enough for that; it is an immense building.

1381. To Mr. *R. Barnes.*]—Do they instruct them in perspective?—Yes.

1382. Is any instruction given them in the application of art to the peculiar manufacture which they are themselves pursuing; for instance, if a young man is a caster of metal, is instruction given him in that particular branch?—No; I believe not.

1383. Then it is in drawing generally?—They go in and go through the regular course, without application to any particular subject.

1384. Are there any prizes given to the students?—Yes.

1385. Who decides on the capabilities of the students?—The master and the governors between them, I believe.

1386. Are the prizes distributed publicly?—Yes.

1387. Is it marked by any peculiar solemnity?—Yes.

1388. What is that?—There is a general procession through the town.

1389. Are the students allowed to dispose of their prize pictures afterwards?—Yes, they are.

1390. The prizes are not only gained by pictures, but also by modelling and various other means, architecture and so on?—There are prizes given in every department.

1391. To Mr. *P. Barnes.*]—Are there such institutions at other places on the Continent

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Continent besides Bruges?—Yes; there are at Ecclo, Ghent, Amsterdam, Rotterdam and Haarlem.

1392. Do you think that has infused a considerable knowledge of the arts among the population in those places?—Undoubtedly.

1393. And you consider that an artizan, taken from the population of such towns where such institutions exist, is a better artist than an artizan would be in a town of a similar size in England?—There is no doubt of it.

1394. But you are not so well acquainted with the other towns in Holland, or the Netherlands, as with Bruges?—No, I am not. I have visited an establishment at Amsterdam called the Felix de Meritis, which has also a department for music and philosophical instruments, and it is a very fine establishment.

1395. Have you any public library at Norwich open to all persons?—We have a public library there; but it is on a subscription of a guinea a year. There is none open to the public free.

1396. Would it not be a very great advantage to the manufacturing population, and would it not improve taste in art, to a certain extent, if libraries were open to them?—Yes; this guinea-a-year subscription one is, of course, above the means of most of the artizans, because they are obliged to purchase a ticket, of, I believe, three guineas in the first instance, besides the subscription.

1397. In the towns which you have alluded to in Holland and the Netherlands, are there not public libraries more generally open?—They are quite free, generally, I believe; I am not speaking of all; at Bruges there is a very fine public library.

1398. Is the establishment that you mention at Bruges connected with any academy of art, or schools for higher classes of art?—The academy itself takes the different grades in art.

1399. To Mr. R. Barnes.]—Does the academy range from the highest degree down to the lowest?—Yes.

1400. There is nothing like a college of artists there?—It is an establishment merely for the purpose of teaching.

1401. To Mr. P. Barnes.]—What is the population of Norwich?—Near 70,000.

1402. What is that of Bruges?—Between 20,000 and 30,000.

1403. What number of scholars are instructed in art in Norwich?—There are about six at the academy, the rest are taught by private masters, and that in a very confined way.

1404. How many students are there instructed publicly at Bruges?—Between 600 and 700.

1405. Have you ever turned your attention to the extension of this establishment at Norwich, by which it might be made available to public use?—I have from the first, with Mr. Barwell, been most anxious that it should be thrown open to the public in the most extended manner possible.

1406. Have you any suggestion to offer as to any means of making it more publicly useful?—If a small pecuniary assistance was afforded by Government, and it could have a correspondence with a central board, it would have the effect of giving those who are desirous and who are connected with manufactures a facility to improve themselves in art, to the great advantage of the fabrics that are manufactured in the city of Norwich.

1407. What do you think would be the benefit of a central board?—I think it would be of considerable advantage to be in constant correspondence with the provincial establishments that might be made in the country; so that if pattern-drawers produced a good pattern they might be protected for a certain period of time under the control or management of the central board.

1408. Do you mean for the protection of inventions and designs?—Exactly so.

1409. Would you have any central institution for educating persons to be masters, and to instruct those in the distant parts of the country?—I think probably that if institutions in the various towns were established, they might produce artists themselves quite competent; but that they should obtain a testimonial from the central board; that they should be made to pass an examination at the central board; if not, then the central board ought to supply proper masters to the provincial establishments.

1410. Do you think central establishments would be of any use in serving as a kind of depôt for every thing that is new in designs and manufactures?—No doubt.

1411. And for keeping up a constant correspondence, not only with the
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Philip Barnes
and
Robert Barnes.

24 August 1835.

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manufacturing districts of the country, but also with foreign countries?—Unquestionably.

1412. You just touched on another branch, protection given to works of design; have you any thing further to say on that subject?—If a pattern-drawer produces a good pattern, which the public would readily purchase, he ought to be protected for a certain time in the advantage of that pattern, because it would otherwise be pirated, and he would not be sufficiently rewarded for the talent he has displayed in the production of that pattern; I hold it to be necessary that all artists should be rewarded for their talent as much as possible, with a view to the public good.

1413. Have you any botanical garden at Norwich?—We have not.

1414. Is it not most desirable to connect botanical gardens, if possible, with institutions for the instruction of the manufacturing population in art?—Undoubtedly. As a proof of that, we have these last three or four years had an establishment of a Horticultural Society, which has greatly improved the habits of the cottagers of the country, and they are now extending them throughout almost every town in Norfolk, viz. Yarmouth, Holt, Aylsham, Dereham and Lynn. A botanical garden would have a greater effect with regard to arts on the manufacturer undoubtedly, because he would be enabled to draw the flowers from the flower itself.

1415. Would it not be very desirable, wherever practicable, to connect such places of instruction with botanical gardens?—If it can possibly be so, it would undoubtedly.

1416. And might it not be easily done without detriment to the botanic gardens?—I should think it might.

1417. And is it not also generally desirable to connect such places of instruction in art with other institutions immediately or indirectly connected with art; such, for instance, as schools of anatomy, schools connected with mathematics, and so on?—The more you can connect them with each other the better.

1418. The greater light they throw on each other?—Undoubtedly.

1419. And might not it be very practicable, where institutions such as those we are speaking of, were established in towns where there are large populations to connect them with such institutions, might it not be for the mutual interests of the different institutions to be so connected?—Undoubtedly.

1420. Is any chemical instruction in dyeing and the combination of colours given in Norwich?—We have no school for that, I believe; but we have some first-rate dyers in Norwich.

1421. Would it not be desirable to have such instruction?—It would be very desirable.

1422. Has dying much improved in Norwich of late years?—I should think so.

1423. To what do you attribute that improvement?—To the competition with the foreign market, and the more general diffusion of knowledge among those classes.

1424. Have you been induced to draw a comparison between the external architecture of foreign houses and those of this country?—I have; the foreign artist abroad has the opportunity of designing the elevation as he pleases, not being confined to the width of his windows by any tax upon them, which in England is very objectionable.

1425. And with regard to the shape prescribed for bricks in England (the measurement of bricks), is that found to be at all onerous?—I think the buildings generally in brick, countries would be improved if the duty was taken off the ornamental brick, or made equal.

1426. Proportionate to the quantity of material used in them, do you mean?—No; I should say, that if you wanted to have an ornamental brick, like this inkstand for instance, you should make one precisely the same as a common brick; now you are confined to a certain size.

1427. You think the duties on brick operate prejudicially in sustaining art?—I think, if the duty was taken off altogether, it would be a great advantage to art generally; the interior decoration of our rooms, as regards paper and other ornaments, is very far inferior to that of the French, for the want of art being more generally diffused among the artizans in that department.

Veneris, 28^o die Augusti, 1835.

WILLIAM EWART, ESQUIRE, IN THE CHAIR.

Charles Robert Cockerell, Esquire, called in ; and Examined.

1428. YOU are architect to the Bank of England?—Yes.

1429. And an associate of the Royal Academy?—Yes.

1430. Your attention of course has been turned to the decorative part of architecture?—Yes.

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1431. Have you experienced any difficulty in procuring assistants in that part?—Yes, very great difficulty ; in our business we have occasion chiefly for ornamental plasterers, carvers in wood, marble, stone, casters in iron, moulders of iron, chasers in bronze, and ornamental painters, &c. &c. I find that we have had a very great dearth of late years (at least 50 years or more) of artists to fulfil those duties. I believe that to have arisen from a change of taste in a great measure since the beginning of the last century, especially the time of George II. and Louis XV. and the introduction of what was assumed to be the Greek and antique taste under Adams the architect, Chambers and others, when cast-work was very much introduced into cieling and walls, cast-work in putty decorations on wood instead of carving on wood, which abounded under Grinlin Gibbon, and under the architects of Queen Anne's time. I apprehend that the system of cast-work and mechanical process has displaced the florid and more elaborate style of our ornamental work ; and I believe that the attempt to supersede the work of the mind and hand by mechanical process for the sake of economy, will always have the effect of degrading and ultimately ruining art. Formerly, for instance, it required a long apprenticeship to acquire the system of ornamental plaster work, done by the hand in cieling : there were artists that were brought up from childhood and passed their lives in that occupation ; there is not one now to be found in this country. A few of those exist in Ireland still ; but during my knowledge of practice, which has been for upwards of 25 years, I may say that we have had but two or three modellers at the same time, who have been capable of executing well the matrix from which these ornamental cast-works are done ; a Mr. Bernasconi till 1820, Mr. Rogers, and more recently Mr. Nicol ; and the consequence of the paucity of hands, the delay and the difficulty has been, that architects have been deterred from the introduction of ornamental works of this description. Within the last few years, however, an improvement has taken place, from more universal acquaintance with fine examples on the Continent, the prosperity of the times, great competition and other causes. Some years ago we had an ornamental painter, Mr. Dixon, but that art has ceased and is altogether lost.

1432. That would not be attributable to the same cause you stated before, which was the preference of casting instead of working?—No ; but it is attributable in great measure to the introduction of mechanical art, generally termed polygraphic, as for instance, all kinds of papering, carried on in France (to which country the observation may also apply) still farther, in the execution of historical subjects, landscapes, &c. in papering, which are well known.

1433. Is it assignable to any other cause particularly?—I think also to the absence of taste during our exclusion from the Continent, and in the absence of encouragement of that class of art.

1434. Do you suppose that the absence of taste proceeds from a want of artists?—Not from a deficiency of talent if properly cultivated ; but I presume that the want of artists proceeds rather from the absence of taste and encouragement in employers, who have not had the means of forming a good taste, and who have not had the wealth, during the last half century of taxation, war and dear living, to encourage those secondary arts which are expensive in this country.

1435. You have stated in the course of your evidence that there have been in your acquaintance, at the same time, two or three artists only who can execute from original designs in plastering?—Only two or three artists who could execute

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well from original designs; in that art there has not been, as I have already stated, great employment for many hands, so little has been the demand.

1436. Do those artists, in consequence of the smallness of their number, charge a higher price than they would if there was a greater number of artists?—Yes, they do.

1437. Do you think if there was a greater number of artists, and in consequence the price of that species of art was diminished, there would be a greater demand for it?—Unquestionably a greater encouragement of such a class of artists.

1438. And a corresponding improvement in taste, and better appreciation of works of art?—Yes, the benefit would of course be mutual. I apprehend that there are two sorts of encouragement; the one, abundance of employment, the other, such an estimation of the art in the public as would stimulate ambition, and urge the artist by the cultivation of his art to seek honours in the higher departments. In this commercial country wealth is apt to be considered the supreme desideratum, and if the artist unites calculation and conduct in business with excellence of talent, he at length becomes a tradesman, seeing no prospect of other reward. Of course this observation applies especially to arts connected with trade and manual labour.

1439. Have you had occasion to consider art as applied to manufactures?—Yes; I have considered it so far as relates to architectural decoration, that is to say, in bronze, steel, plate, and iron, papering and occasionally china, &c. and whatever manufactures depend materially on design for their effect. Having resided a good deal abroad, I have been piqued as an Englishman at seeing the great superiority of foreigners in that respect. I have visited the manufactories of this country with a view to this question, and I have exceedingly lamented the want of instruction I found in those manufactories, but I have much more deplored the indifference shown by Government on a subject which materially concerns the honour and character of England as respects arts, and which is of paramount commercial and national importance in a manufacturing country, where the cultivation of taste only is wanting to give us the superiority over the world.

1440. Did you turn your attention to any particular species of manufactory, or did you take the whole range?—Yes, especially those employed in architecture, as, for instance, brass works, applying to balustrades, furniture of doors, grates, stoves, plate, cutlery, and similar works done at Birmingham, which an architect is often called upon to direct. I have found that, from the ignorance of the true principles of design, there is a constant waste of capital in the capricious and random endeavour to catch the public taste; I have freely commented upon this deficiency, and have generally found it confessed. The manufacturers are not sufficiently impressed with the necessity of a higher culture of design; they generally dabble themselves, and put things together from books; they purchase books of design with avidity, and I have known them buy up the stock of a bookseller to secure the exclusive advantage of a rare publication of patterns. Some years ago his Grace the Duke of Northumberland had the liberality to lay out a large sum in his house at Charing-cross on manufactures wholly English, and of unusual magnificence. I followed the execution of these in various manufactories, and found them always at a loss for design and models well understood, and confessing, according to their own words, the deficiency of the master hand.

1441. Were those works executed after the taste of any particular æra?—Generally what may be called Grecian.

1442. In what respect do you consider the productions of foreigners, in articles of porcelain, superior to those produced in this country?—Unquestionably in the forms and in the design of ornament, and the adjustment of colours.

1443. Do you mean the colours are better prepared, and that there is a greater degree of brilliancy in them?—I should say the harmony of colours, as applied by artists in the painting of flowers, history or landscape, &c.

1444. In which of those do you think foreigners are superior to the English, I mean as regards porcelain?—Flower-painting and ornamental scroll-work, and the blending of the gold with the proper colours.

1445. How far do you conceive that is connected with the art of design?—First of all, I conceive the beauty of the porcelain must depend upon its form, and its contrivance; for instance, the works from China, in which we see animals introduced, not only with a view to ornament, but for real utility, as handles, feet, &c., as also in the antique vessels in pottery or bronze, we constantly observe an admirable adjustment of such useful and ornamental portions of the work, full of taste

taste and meaning; and, secondly, the beauty of porcelain must depend upon the arrangement of the design, and colours painted upon it.

1446. Did you pay any attention to the different qualities manufactured abroad; for instance, at Paris, at the manufacture of Sevres, and those made at the common manufactories in the neighbourhood of Paris, for common use?—Upon the quality of the material, I cannot pretend to answer; I merely speak as to the art or design employed on the work. I beg to mention upon that subject, that my friend Mr. Isabey, the miniature painter to Napoleon, was occasionally employed at Sevres; his talent, which is the first in France, had been employed by the Government in historical painting, and portrait and ornamental painting in the china works got up at Sevres. I may add on this subject, that amongst a large acquaintance I made at Rome of French artists brought up at the Academy, (of whom I think there are from two or three painters sent annally from Paris to Rome to study, and of those men I think I have known about 15,) there are not above three or four who have become celebrated, the rest being very accomplished men, but scattered throughout the provinces of France, and transferring all their knowledge to the different manufactories and provincial schools. I have seldom heard of these men, except that they were living in their own provinces, without much fame in the upper branches, but their skill honourably employed in assisting various manufactures.

1447. Are you acquainted with the mode in which the persons sent from France to Rome to study are supported; if at the expense of Government?—Yes, of Government. The students of the Academy at Rome live and study together in the different museums at Rome; the Academy was instituted in the reign of Louis XIV., with every possible advantage which students can have; indeed, too many; and all the evils of the academic system have been experienced there for many years, and have been lately avowed publicly by Monsieur Vernet, their president. The evils of too close an adherence to the academic system are as great nearly as the total neglect of it in a country.

1448. With regard to the art employed on porcelain not under the protection of Government, what is its comparative merit with that of England; you have mentioned Sevres; now draw the distinction between that establishment, and those which depend on popular support?—I should say, that the latter follow the higher example of those schools instituted by Government.

1449. Do you mean to say, that they have as much excellence in manufacturing porcelain?—Not the same excellence, but they imitate more or less the higher manufacture.

1450. Is the taste exhibited by such persons, depending upon popular support, equal or superior to that exhibited in England in the same branch of manufacture?—I think it is superior; they look to higher sources of design on the Continent generally.

1451. You do not think there is a sufficient diffusion of talent among artizans in general in this country?—There is an abundance of talent, but a want of opportunity of obtaining more correct knowledge of design.

1452. There are not the means of diffusing them among those persons who are capable of such instruction, if afforded them?—There are not the proper means in this country.

1453. Have you considered the relative state of arts, as applied to manufactures, as compared with England and the Continent?—I have.

1454-5. What is the result of your inquiries upon that subject?—I apprehend that the object of legislation on this subject must be the multiplication of industry and commerce, as well as to give splendour and do honour to the country. The Governments of the Continent have been always better and more systematically directed to arts and manufactures than by our own scattered endeavours, especially in the higher departments, by establishment of professors of archæology furnishing the learning necessary, academies providing accomplished hands, by premiums on manufactures, direction of some of them, by exhibitions of art of all ages gratuitously, thus diffusing taste through every class of society from the manufacturer to the purchaser. The result on my mind has been, a conviction of the necessity of such means in this country as they have on the Continent, which, superadded to the capital and industry of this country, would give us the superiority over every other in arts and manufactures.

1456. Do you consider the arts are more in general diffused among the classes
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of artizans on the Continent?—Unquestionably, inasmuch as the leisure of the artizans in most of the cities, of France especially, is passed in the palaces and gardens of the king, where they have beautiful works before their eyes, in architecture, sculpture and painting; a paternal and enlightened government long ago (near 300 years) provided these elegant recreations for the people, instead of passing their holidays, as our artizans do, in the pot-house. In various manufacturing cities which I have seen very lately, as Sheffield, Birmingham, Glasgow, &c., I have been struck with the degrading comparison.

1457. You are very favourable then to the opening of public galleries containing works of art of all descriptions, and the free admission of the public to those galleries?—By all means, especially as connecting their amusements with a more refined recreation, as well as affording them the gratifications of curiosity or study.

1458. I suppose your remarks would more especially apply to manufacturing towns, where generally the habits of the people require much recreation, and where their occupation is also connected in some degree with the arts?—Certainly, and every man must lament, and especially an artist, the absence of those places, such as public gardens and parks, with sculpture exhibited in the open air and in galleries, museums of natural history, botanical gardens, &c. Many of the noblemen's houses within reach of our manufacturing towns contain such museums and collections as would have conferred the utmost advantage upon them if so bestowed. I beg to mention as an instance of this kind of liberality, that Sir Robert Lawley gave a gallery of casts some years ago to Birmingham, which has formed the foundation of a collection there.

1459. Can you mention any instance in the provinces where an artist educated in the higher branches has devoted himself to the more simple process of introducing art among the manufactures?—Yes; I have already cited Mons. Isabey and the French academicians; in this country I know that Mr. Briggens, a very able artist, established himself at Birmingham, but though fully qualified, he did not succeed, and left the place about ten years ago. This I must attribute to want of discrimination in the public taste as well as in manufacturers, since they would have paid for design if worth their while. However, all experience both in ancient and modern times shows, that if able artists confer advantages on manufactures, they in their turn have often produced great artists.

1460. Do we draw the inference from that, that it is desirable even among artizans to encourage the knowledge of correct principles of design, to encourage among the lowest class all that portion of art founded upon principles which may be called almost the science of art; for instance, the knowledge of correct drawing, proportion, perspective or any of those things; would such instruction be or not a benefit to the mind of artizans in so far as they are artists?—I do not think such knowledge compatible with the occupations of artizans, and the encouragements to it would mislead them, and interfere with their proper callings, and right division of labour, in which excellence already requires all their ability. There is a wide distinction between art and fine art; in the latter the knowledge of artizans whose bread is earned in laborious work, must be always very limited, compared with those who have an original genius for it, and have been brought up in the highest schools, and with the best opportunities of instruction. This knowledge is a science of itself, and requires a life to attain. There is every respect among artizans towards men of superior knowledge, they bow to them, and follow them implicitly if they have reputation for merit; but I apprehend that any attempt at a general diffusion of the higher principles would be futile. Those principles may be in a measure imbibed by the constant view of fine objects, and the encouragement of men brought up in higher schools to instruct in the lower branches of arts and manufactures, would be, in my humble opinion, the best course.

1461. Do you consider the ancients dwelt much upon the importance of the connexion between manufactures and arts?—I should say the evidence of all history, especially Grecian, confirms the fact of their solicitude on that subject. We know that a stranger who established a new manufacture in Athens, obtained the rights of a citizen. Athens and Ægina were the great manufactories of Greece in all works connected with fine arts; some of the most illustrious philosophers and statesmen were sons of manufacturers, or some way connected with fine arts. The artists of Ægina had more commissions in all parts of Greece than any other nation. The manufacture of bronzes, especially candelabra, is celebrated by Pliny.

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Herodotus informs us that they had a protecting duty on fictile vases, and there were peculiar laws for the protection of manufactories and the restraining the artists from emigration. Great artists arose from the manufacturing establishments; and again, it is apparent from all their works that those artists who had failed in the higher branches applied themselves to the lower ones, and we have admirable works of a minute and minor kind comparatively, such as vases and bronzes, armour and medals, which unquestionably are executed by men who have worked upon a much larger scale, and attempted very much higher things.

1462. Have you designed for manufacturers?—I have had occasion to design for various branches of manufacture; and I have found that a very particular devotion of study is requisite in the application of art to the particular material and mode of workmanship, in every branch of manufacture, and that in fact each requires a practised artist.

1463. I understand that you have designed for manufacturers?—Yes, I have designed for Rundell & Bridge, at the time they employed in the same occupation Mr. Flaxman, Mr. Stodhart, Mr. Bailey and Mr. Howard; and one of those gentlemen specially attached to the concern received a salary of 500*l.* a year, and a house to live in, and a portion of his own time to employ in his art, not in their interest, and apprentices who working under him were separately charged against the house; and I had occasion to know that they spent in designs alone 1,000*l.* a year and upwards, and quite as much more in the higher order of chasing, and the execution of ornamental works. In illustration of the magnificent and enthusiastic patronage of manufacturers, and the honour and advantage they confer upon their country, I beg leave to mention an anecdote of the late Mr. Wedgwood, related to me by Mr. Cumberland, of Bristol, who wrote a pamphlet in 1792, recommending a national gallery of sculpture, casts, &c.; in aid of which Mr. Wedgwood made a tender of 1,000*l.* I beg further to say, that I have found Wedgwood's works esteemed in all parts of Europe, and placed in the most precious collections of this description of works.

1464. As such designer, have you had any opportunity of observing that any want of protection exists for the invention of the artist?—Yes, in a great many instances; and to my knowledge that house in particular (Rundell & Bridge) has suffered most materially from piracy.

1465. Do you mean to say, that when they have paid an artist a high price for a beautiful design, that persons in the same trade have copied the design and offered it at a less price?—Yes, that has been the case in every business of this description.

1466. And do you consider that upon that account there has not been so much encouragement in the employment and the payment of a high price to that particular class of artists?—Decidedly so; because, say they, we pay you to design for other people. That is especially the case in paper and in furniture, and in floor-cloth manufacture. It was but yesterday I had occasion to see a very eminent floor-cloth manufacturer, and who stated to me that his designs were copied within a few weeks after he had issued them, by a cheap house in Bristol. These gentlemen express their obligations for the designs, but they say, “we cannot continue to employ you, because we have no protection for the designs after they are made.”

1467. Have you ever turned your attention to the mode of protection necessary?—I have not particularly done so, but a cheap and summary remedy to the evil is necessary. I understand that wherever questions of patent have come before the Court of King's Bench, there has been a disposition always on the part of the jury to favour the liberal construction of the case, as they conceive it, and to oppose exclusive rights; so that a person in defending his patent is very much discouraged.

1468. Would it be any advantage if the protection were afforded in these cases at a shorter period than patents are generally taken out for, which is for seven or fourteen years; do you not consider that a limitation would be advantageous?—Various terms adopted for various materials.

1469. And that the degree of protection should vary with the necessities of the case?—Yes, from the nature of the material and the fluctuation of fashion, which changes in paper, floor-cloth, printed and painted wares more readily than in silver, bronze and other expensive materials.

1470. Is there any protection at present for printed papers?—I believe not; I judge from the dilemma the manufacturers are always in, between their solici-

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tude to show their inventions to purchasers, and yet to conceal them from manufacturers; in receiving a customer, therefore, they have first to discern whether he is a purchaser or a pirate.

1471. Would three months, which are now allowed to the maker for the protection of designs in printed cottons, be sufficient for the designer of paper?—I should think three months rather a short period.

1472. Have you ever considered whether there should be any system of registration employed for designs?—I conceive that to be a very certain mode in some sorts of manufacture, and a summary legislative power by a jury of certain persons well acquainted with the art; for such particular acquaintance is necessary to recognize and distinguish the principle of a design through any attempted variation of the parts; and this is a point of some difficulty, and has been found so in patents.

1473. Do you not think an injunction in the Court of Chancery is the best means, if you can obtain it at once?—Yes, if at once, but hitherto it is an expensive and tedious mode, and the object is often lost during the process.

1474. Have you had occasion as an architect to turn your attention to the effect of the Excise law which regulates the shape of bricks?—Yes.

1475. Can you state from your own knowledge what is the difference of Excise charge?—I have long known that the Excise levy a great increase of duty upon bricks moulded out of the common way, being 5*s.* 6*d.* on common bricks and 9*s.* per 1,000 on bricks exceeding the common size in any dimension, so as to dissuade architects from the use of moulded bricks in their works. The celebrated Sir Henry Wotton complains of the want of knowledge in this respect in England, observing that there was generally too much of the material of bricks in the makers.

1476. As an architect, do you think any person who was desired to form a stack of chimneys with moulded bricks, according to the beautiful models we have in the old buildings, that he would be dissuaded from adopting such material from the effect of the Excise charge solely?—Not solely; the expense of moulding and the charge that comes upon that expense would be too much to make it worth his while, since it amounts to the price for which they could be done in stone.

1477. Suppose it were doubled, or even trebled, would not the mere models or the cost of the bricks, for the use of a work of that kind, be a great proportion of the entire charge?—The increase would be so great that they would rather execute it in Bath stone.

1478. Is there any thing else you would wish to state?—I would wish to offer, with great deference, my opinion on the advantages derived from galleries of casts of classical objects in sculpture, in parts of architecture, vases, casts from bronzes and from fine works of all periods, botanical gardens and museums of natural history, open to the public, which, wherever they do exist, I have observed to be extremely frequented by the public in this country. I have seen and watched with very great interest the establishment and growth of institutions for the encouragement of the fine arts in Dublin, Edinburgh, Bristol, Birmingham and many other places; these have been raised by the subscriptions of individuals, often manufacturers themselves, very enthusiastic for the honour and for the real improvement of their native towns; but the means being very small, they have been obliged to support them by the attractions of fine art and annual exhibitions; they have not been able to bring them to bear more directly on manufactures to such an extent as they otherwise might have done; and I doubt not that if those institutions were in a situation to add to their means, by the encouragement and aid of Government, afforded under proper conditions, and were enabled to give rewards, and to hold out premiums for works wholly applicable to manufactures, that the original promoters of those institutions would be gratified and stimulated, and the ultimate objects of those interesting schools would be fulfilled; a permanent solidity would be given to those occasional and fluctuating efforts of enthusiasm or prosperity, of which we see so many examples, and the Legislature would obtain the desired effect at a much cheaper rate and more effectually, than by any other means I have been able to contemplate for the general improvement or application of art to manufactures. I am acquainted with many of these schools. I was in Birmingham the other day, and saw that since my visit eight years ago, a very respectable academy had been established there; and there are from 80 to

100 young persons learning drawing belonging to that academy, as well as independent schools, as that of Mr. Line's.

1479. What are the class of persons attending there; are they artizans or sons of artizans?—Sons of artizans and tradespeople. Several schools are to be found in London, where instruction is given in the rudiments of drawing required by joiners and other artizans at a very low rate; but they are all on a limited scale, being started by individuals. I have a firm conviction, arising from long acquaintance with the subject, that there is a superabundance of artists in this country, and for one who thrives, a large proportion are without employ; and that the unsuccessful class are not so well paid as good mechanics. In this country there is a great propensity to art, and its attractive nature will always supply abundance of artists; but they have not been directed in a course to apply their art to manufactures, from the causes above cited, especially the want of scientific means, and an encouragement to this end, and legal security in their patterns.

1480. Has any decided improvement in the public taste taken place within the last 20 years?—Certainly, since the almost universal acquaintance of artists and the public with the Continent, the general prosperity of the times, and the improvement of mechanics, who were never so well paid as within that period.

1481. Do you consider that the continental taste is purer than ours?—Yes, unquestionably, and on better principles.

M. Felix Bogaerts, Professor of History at Antwerp, called in;
and Examined.

1482. WHAT means are adopted for giving the people of Belgium education in the arts?—We have different means. Our first schools are the Sunday schools: in them the children of the poor are instructed to the number, in the city of Antwerp, of from 7,000 to 8,000. Instruction is given not only in reading and writing, but also in design. The children educated in such schools are therefore qualified (so far as their future occupation may be connected with the arts) for the exercise of such occupation. Since the institution of these Sunday schools the intelligence of the people has been greatly developed in reference to the arts. Those children in the Sunday schools who show a disposition for the arts, are encouraged to pursue it. Not only, therefore, do they find encouragement in the workshops of the manufacturer, but (if they have a taste for superior art) in the studio of the artist. A vast number of painters at Antwerp have risen from the lowest classes of society.

1483. Are you of opinion that drawing should make a part of education?—Most certainly.

1484. Do you consider that the taste thus diffused amongst the people is not only useful for the improvement of manufactures, but also as a means of extending national taste?—Undoubtedly I think so.

1485. You have mentioned that the instruction of the people in art is first by means of these Sunday schools; what is the next step for the instruction of the people in art?—The next step is taken in the academies. The fine arts are taught at the academies; but that part of academical instruction which is devoted to manufactures, is only feebly developed in them.

1486. Do the workmen frequent the academies?—Certainly.

1487. Are the academies open to all the world?—Yes.

1488. Can the workmen attend the lectures of the professors of the academies gratis?—Yes.

1489. How are the professors paid?—They are paid by the city or town in which they lecture. Of all the schools of the academy, that which is most frequented is the school of architecture. There they learn perspective, the interior decoration of houses, and various branches connected with internal and external architecture.

1490. Are these Academies at which the workmen receive instruction common to all the cities in Belgium?—Certainly.

1491. Are there also daily schools in which instruction is given in drawing?—Yes.

1492. According to your representation, may we not infer that the knowledge of design and a taste for arts is very much diffused amongst the people of Belgium?—Decidedly.

1493. And that within the last few years the knowledge of design and a taste for

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Esq.

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M. F. Bogaerts.

Professor
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for arts among the people of Belgium is very much extended?—It has been very much extended indeed of late years.

1494. From what time do you date that extension?—From the last re-organization of our general system of instruction.

1495. How long is it since the general system of instruction was re-organized in Belgium?—Within the last 15 years.

1496. Since the introduction of design as a portion of national education, have the manufacturers of Belgium improved?—They have.

1497. Has the national taste improved?—It has.

Luna, 31^o die Augusti, 1835.

WILLIAM EWART, ESQUIRE, IN THE CHAIR.

Charles Toplis, Esquire, called in; and Examined.

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1498. WILL you inform the Committee how you are connected with the London Mechanics' Institution, or with the artisans and manufacturing classes of the country?—I am one of the vice presidents of the London Mechanics' Institution, and I am also director of the Museum of National Manufactures in Leicester-square.

1499. What part of the Mechanics' Institution relates to the instructing of artisans in design?—There are three schools, all of which are superintended by masters that are appointed for the purpose.

1500. Will you state what departments are taught by those masters?—There is one class for teaching geometrical and mechanical drawing; that is, drawing to scale with the aid of mechanical instruments; another class for teaching the drawing of ornament; and a third class for the human figure, and I believe there is a fourth class for landscape, at least there was some time ago; I am not sure whether it still continues, but I believe it does.

1501. Do they teach perspective?—They do in the geometrical and mechanical drawing class.

1502. Is that sort of instruction given which would enable a person to draw patterns for fancy goods?—That is one of the branches which I include under the designation of ornamental drawing; but it is not precisely that kind of drawing which has been practised in these classes; however it would give them the facility for turning their faculties that way.

1503. To a certain extent you educate them for pattern-drawing, do you?—Yes, by giving them the preliminary education, certainly, though it has not been expressly directed to that one object.

1504. Do you give them means of studying the beautiful specimens of the antique, either in statuary or in vases?—There is another class for modelling, where they have such specimens, though not to the extent they ought to have them; but they have minor specimens, such as their own means can command.

1505. Have you any gallery of casts?—No, only the casts I have just now alluded to; the detached pieces; we have no gallery of entire figures.

1506. You have no such gallery as would amount to an exhibition of works of art, have you?—Certainly not; there is a museum of models, apparatus and specimens of minerals.

1507. How do you think that those branches of the art of design which are taught in the London Mechanics' Institution suffice for the necessary education which would be desirable for artisans in design?—I think there is a very fair ground-work laid, but it would require extension; for instance, in that department, which has been mentioned of pattern-drawing, it ought to be carried out into that, and into other very important branches of manufacture, one of which may be cited, namely, the porcelain and earthenware manufacture.

1508. Have you ever had under your consideration the propriety of not only teaching the artisans design, but also of teaching them the connexion of design with the peculiar trade which they pursue?—I have attended to that, and have expressed my opinions upon those points in what I have written here.

1509. The

1509. The meaning of the question is this; suppose that you have a master to teach design, do you not think that it would be also necessary to have some person who should stand intermediately between the design and the fabric to which the design is to be applied, and show how the one is to be adapted to the other? —Yes, certainly; I conceive that the elementary schools of design would be of the same value for all; after they had made a certain progress in the schools, it would then be necessary to draught them out into the particular department of manufacture which their inclination or their talent might lead them to; that then they would require express instruction in those particular branches; for instance, in the porcelain manufacture, it is requisite that a painter there should be able to paint landscape and other natural objects, perhaps to compose pictures, but at all events he should be able to copy a landscape or other representation accurately; but then the management of the colours and other materials used in the porcelain painting requires express teaching, and that knowledge he must derive from some master appointed for the purpose; he would in fact have to undergo an apprenticeship in that particular art; but his previous preparation in the school of design would qualify him to attain the particular technical application of his art in a comparatively short time, so as to make his labours become profitable both to himself and his employers in that particular department.

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1510. You are acquainted with the application of the designs to manufactures through the medium of the Jacquard loom, are you not?—I am.

1511. Is it not necessary in the application of design to the production of figured tissues there, that the artisan should to a certain extent be an artist, so as to know how he could call out the design into existence on the fabric which he is weaving?—That is not necessary to the weaver, because the loom is set for him.

1512. Is it not necessary for the person who sets the loom?—It is quite necessary certainly that this man should be imbued with the principle of design; he should have certain tastes, and know what forms will have the best effect upon the tissue.

1513. In fact, it is the intermediate instruction which applies the design to the fabric, is it not?—Yes; the workman himself has nothing whatever to do of necessity with the design; he weaves with perfect indifference all sorts of designs, the cards which give the pattern being put into the loom, and they operate the design without any knowledge of it being required on the part of the workman.

1514. Have you been in France?—I have.

1515. Have you had an opportunity of observing the means by which artisans are instructed in art in France, and the effect which such instruction has upon them, that is, by opening galleries?—In Paris, the splendid collection of the Louvre is open to any applicant there to study, to make copies from the pictures and from the statues. In Bourdeaux they have a similar collection, not upon the same scale as the Louvre, but they have a collection of pictures and of statues which are also open to any applicant to study. In Lyons, I believe, their schools are more expressly directed to their peculiar manufacture, namely, the silk manufacture. I believe it is the case in their university schools, that they are open indiscriminately to all students. The university of Paris and the medical schools are there open. They have also schools for the training of artisans; they are at present re-modelling or rather re-organizing, I should say, the Conservatoire des Arts et Metiers, and there is now a series of models made by the pupils of one of these schools, which are made in a creditable and workman-like way; that is, they are made to scale and correctly finished. They are going on to complete an entire collection of all the most useful machines that are employed in great works and in manufactures.

1516. Will you continue any observations you wish to make further on the subject?—In their manufactures generally which I have examined, there appears to me to be more care bestowed upon the ornamental part of it, and in many instances a better taste displayed, that is, more in conformity with recognized principles of taste than we generally observe in ornamented manufactures in this country. The close study of the fine forms of antique sculpture and painting manifests itself in a great number of the productions of their manufactures.

1517. What manufacture would you principally specify as exemplifying that?—I should advert chiefly to the porcelain manufacture and their ornamental casting.

1518. Should you mention paper as a specimen?—That I should also include, that is, their coloured papers, their hanging papers; in that they are very far before us certainly.

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1519. You have mentioned as one means of instruction in France, the gratuitous access to these collections?—Yes.

1520. Are there any other sources of instruction to which you would attribute the superiority you ascribe in design to them on the part of the artisans?—The particular schools established in particular districts where the manufactures are; I should say in Alsace, at Lyons and at Rouen.

1521. There are eighty schools altogether, are there not?—Yes.

1522. Is there any system adopted in France for teaching the artisan the intermediate process of connecting design with the peculiar branch of manufacture which he is to pursue?—That I believe exists at Lyons; they are expressly trained to that there.

1523. Would it not be very desirable to have that species of instruction given in England?—Unquestionably; it is my opinion that nothing would more facilitate the useful application of the art of design to manufactures than the appointment of intermediate masters to train the student from his general knowledge of design to particular branches of productive manufacturing art. They all bear such distinct characters that it becomes in fact a separate occupation: the man who is qualified for designing the ornaments of an iron-foundry would be at a loss to design for the paper-hanger or for the china-painter. In many cases the peculiar manipulation of the manufacture demands a peculiar knowledge and peculiar tact in the artist who is to design for that particular branch.

1524. Then the principle of your instruction would be, that you would give general education first of all in design, and next you would allow the artist to follow that branch for which he had a peculiar talent?—That branch for which he appeared best adapted.

1525. And in choosing that you would follow the principle of the division of labour, and turn his attention as much as possible to that?—Certainly.

1526. After that would you allow him, when his education had been sufficiently completed, to go forth and become a designer in any part of the country where there was a demand for such species of design as he had devoted himself to?—Yes.

1527. Do you think that persons so trained would find sufficient employment among the manufacturers?—I am quite of opinion that they would; and the readiness with which he would find employment amongst the manufacturers by any excellence which he had attained in these schools, would be a constant stimulus to exertion in the schools to reach that excellence. In France I believe it is found to be invariably the case, that when a boy has acquired a certain ability in the arts of design, and has shown taste and genius, he is eagerly sought for by the leading houses, and when he is of good moral conduct, he commonly terminates his career by becoming a partner in the house.

1528. Are you aware whether the statement you have made is not exemplified also by the extreme encouragement which some English manufacturers have afforded to design; taking, for instance, the well-known manufactures of Wedgwood and Davenport, who have been very anxious to encourage design?—Yes; and I have known several instances of manufacturers, particularly in the porcelain ware manufacture, who have been exceedingly inconvenienced for want of able artists to carry on their works. I know one house now that has had in hand, I think for at least four years, a service of porcelain for The King, and it has been retarded in its finishing a very long time by the manufacturer's inability to procure a sufficient number of first-rate hands to do the painting upon it.

1529. Would the manufacturers in those cases have to pay high prices to the artists whom they employed?—The manufacturers in such cases have to pay a higher price in the ratio of the scarcity of artists; yet there are in this country but a few first-rate artists in this branch of business, and they can command their own rate of compensation.

1530. You say the manufacturers would employ such persons abundantly?—I believe that class of persons in the porcelain and earthenware manufactures are well employed, that is, there is a constant demand for their services; but if you were to educate them, you would have the same ware which is now ornamented in very bad taste ornamented in good taste.

1531. In fact, in the instances you mention art is dear?—It is.

1532. And that proceeds from a want of diffusion of taste and design among the people?—Palpably so, because the greater part of these works of art are even works of very vile art; they take the worst of copies, and that is one instance of the want of education in the fine arts, in the superintendents, because they frequently take very imperfect works and give them to their workmen to copy. Were
a general

a general taste diffused among the manufacturers as well as among the workmen, it would be as little expense to give graceful ornaments to their ware as it is to give the rude, barbarous coverings with which they still ornament their ware.

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1533. Is not originality of design very scarce, and is not art chiefly confined to copying?—Yes, it is. I can give an instance of that; the common earthenware manufacture takes its style of ornament from China, that was brought over here many years ago; they still continue that barbarous style of covering which the Chinese had adopted. A very great improvement has been recently made in the means of multiplying the copies of designs for transfer to the surface of the ware, by printing off a continuous sheet, and such is the constant demand,—but this comes from the bad taste of the public perhaps,—such is the constant demand for the old Chinese barbaric ornaments, that they have been obliged to engrave their cylinders in the new machines to those patterns, though they have at the same time brought forward much more tasteful designs of their own; but still the great demand by the public has compelled them to adopt the old rude style of ornament.

1534. In the case you have alluded to in executing the order for The King, would there be greater facilities for executing that order in France than in England?—I should think there would be. It appears to me that they turn out their large pieces of porcelain much more abundantly than we do, and I know perfectly well that they do larger works with more facility than we can.

1535. You laid down the principle that having instructed the artisan to a certain extent in the general principles of design, you would then allow him to confine his attention to the particular branch of manufacture to which the design is applicable?—Yes.

1536. Have you ever turned your attention to the best mode of carrying that principle into effect?—Were I to set about it, I should take a man perfectly conversant with that branch of the business, and give him the pupils, and say, “Now you take those pupils, and instruct them in all that is necessary for this particular department;” in the instance of porcelain he would say to him, “You have been accustomed to use such and such colours, which are at once obvious to your eye; you know the colours you are going to apply to your picture by their appearance on the palette, and you know they will have the same effect to the eye which they have upon the palette; here you are going to encounter a totally different principle; you are taking a colour which is totally different in appearance to what it will be when it has been subjected to the process of burning. This is perfectly new to the student; he then has to be instructed in and shown what are these changes that take place in the colours in the operation of burning. This is a preliminary training which he must necessarily go through.” Then there is the effect of different fluxes upon the colours, the effect of the different combinations of colours, the quantity of flux that is necessary for one colour and is necessary for another that are to be exposed to the same degree of heat; the colours that require different degrees of heat; and all these technical peculiarities must be taught to the general student of design. He is only qualified before he comes there by training of the eye and the hand; his eye can measure forms and trace their contours, his hand can make the copy upon a plane surface of those forms.

1537. The instance you have given in the case of porcelain, is an exemplification of the principle which would generally apply to the adoption of design in manufactures, is it?—Yes; for in the iron foundry, for instance, the student who had been taught to draw ornaments upon a flat surface, appropriate to that kind of material, would have to be taught when he comes to apply himself to this particular branch, that all kinds of forms would not be admissible; they would not deliver from the sand; he must have a peculiar knowledge of what will and what will not be manageable in the hands of the moulder, and then he comes to a peculiar technical training. That is another instance, and I fancy it will be found generally to prevail all through.

1538. In order to subdivide instruction in art in this way according to the manufacture to which it is to be applied, would you adopt any central system of instruction, would you educate masters in these peculiar branches, or what course would suggest itself to your mind?—I think it would be most economical to the public to establish these secondary schools in the field of the peculiar manufacture, as in the instance of the French silk manufacture they do at Lyons. All that applied to the connexion of the arts of design with the ornamenting of porcelain and earthenware, would be best taught in Staffordshire. The iron foundry is too universally spread to say where it would be best situated, but perhaps it is one of

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those which would be best in London ; and there are certain other diffused branches of manufacture, where a central school would be the only one which could be conveniently established.

1539. What would be the benefit of a central school?—The students would be more numerous, because you would collect them from the whole kingdom.

1540. Would the facilities of instruction be greater?—They would, because the greater the number of pupils, the more economically you can educate them. There is a central school in London, for what is called the teaching of art, but the misfortune is that there are no teachers ; that is, the Royal Academy ; the students are drawn there from all parts of the kingdom, and when they get there, there is very little or no instruction.

1541. How far do you think it would be desirable that the Government should interpose to assist in the formation of establishments, such as those you have recommended?—I think, as it contemplates a national benefit, that schools should be established at the national expense.

1542. You have laid down certain principles for the education of artisans in art ; do you think it desirable or not, that besides the direct instruction which you have suggested, they should have also collateral assistance given to them by opening as much as possible galleries and exhibitions, where they might freely see all that is most beautiful in art, without any difficulty at all?—I think that is certainly desirable to the students, and I think it would have this further beneficial tendency, namely, that of improving the taste of the community in general, which wants educating certainly as much as the artists that are to minister to their taste.

1543. From your knowledge of foreign countries, do you think that the people of this country have had justice done to them in the way of instruction by the free exhibition of works of art?—I think not.

1544. Do you think that there is any want of talent for art in this country, or for a natural appreciation of it?—I think not ; I think we have instances of as much fine taste in this country as has been exhibited in any part of the globe.

1545. Do you think that the people of this country have had equal advantages with most foreign civilized nations for developing their taste in art?—I think not.

1546. Do you attribute that to the want of free and open exhibitions to the public of works of art?—Yes, and I would instance another case in Paris, and the public gardens and buildings around there ; they more freely ornament their grounds with fine works of sculpture than is done in any of our public places.

1547. Do you think that the climate of this country is any objection to that?—I think there is some little inferiority in the climate of this country.

1548. But there are some instances in which that does not apply, are there not?—Yes.

1548*. In iron statues they would not be affected by the climate, would they?—No, our metal statues stand very well ; marble would be the thing that would chiefly suffer. I think it would be possible to form, at a moderate expense, large collections of plaster casts, which would improve the taste of the country equally with the originals.

1549. You have suggested the subdivision of the study of art as applicable to different manufactures ; you have also suggested the expediency of open galleries accessible to the public ; will you, in the third place, say whether you have ever thought it would be a desirable thing to make design to a certain extent a portion of national education ; that is, wherever there are popular schools of education, day schools, authorized more or less by the Government, and formed on a systematic plan, you would then use means of infusing a certain knowledge of the principles of design into the minds of the population?—I am of opinion that the arts of design are so extensively useful to almost all classes of operatives, that after the first elements of teaching, such as reading, writing and arithmetic, I would make the arts of design a necessary concomitant of that branch of education.

1550. Do you think that such a system would be useful to make our workmen better artists, and to create in the people a greater demand for works of art, and to elevate their minds, and enlighten their understandings?—I am quite of the opinion that that would follow, and I have here expressed it.

1551. Would it be a difficult thing by any means to make, to a certain degree, the knowledge of design a part of national education?—Not at all ; I think it is quite as easy to teach the arts of design, as it is to teach the art of writing.

Mercurii, 2^o die Septembris, 1835.

WILLIAM EWART, ESQUIRE, IN THE CHAIR.

Charles Toplis, Esq. called in; and further Examined.

1553. AS you are particularly familiar with mechanics' institutions, will you state to what extent and in what respects the constitution of those institutions is favourable to the development of art?—With the permission of the Committee, I will begin with giving a general statement of the objects of mechanics' institutions. The spontaneous origin, the progressive extension and the steady self-maintenance of mechanics' institutions throughout the country, are indisputable proofs of the existence of a strong desire for knowledge of a different character from that which the active classes of the community could heretofore derive from the educational establishments to which their station, leisure and pecuniary resources gave them access. The contracted and inflexibly perverse appropriation of the endowed schools of the country to the gratuitous dissemination of that kind of knowledge which never was, nor by possibility ever could be, of the smallest practical utility to men devoted to productive industry, had long since rendered the proffered boon of free instruction a mockery to that portion of society for which free education was ostensibly designed. In sterile schemes of tuition, calculated merely to rear men for the cloister, the mechanic, the handicraftsman and the peasant found nothing to aid them in their pursuits, and they had of necessity abandoned the free-schools of the country to the few whose leisure and resources allowed them to waste the whole term of education on the profitless acquisition of the Greek and Latin languages. The funds which had been appropriated to the gratuitous spread of information amongst the multitude, had become the succour of a limited few, who were pursuing what is deemed the necessary course of a professional education through the least expensive channels, or they had lapsed into the sinecure emolument of wholly unoccupied public instructors. The private seminaries which admit scholars for pay, are either too expensive for the resort of the many, or the course of instruction within them is too meagre for the wants, or too foreign from the pursuits, of the productive classes which constitute the bulk of those whose necessities demand cheap education. The people, who felt the privation and saw the necessity of appropriate elementary instruction, communed with each other on their common wants, and combined together to effectuate the object of their common desires. They associated themselves for the purposes of mutual improvement, and under the impressions of their peculiar necessities devised for themselves methods and matters of study which assorted with their avocations, their leisure and their pecuniary means. Ten years of experience have now shown at how easy a rate, through associations like the self-created mechanics' institutions of this country, sound, profitable, practical education may be disseminated amongst a people. The money contributions of the individual members are so moderate as to be little burthensome to very large bodies of the community. These periodical payments range from twelve to twenty-four shillings per annum, divided commonly into quarterly payments. The aggregate amount of the contributions commonly suffices for the hire of a building, the salaries of one or more residentiary officers and attendants, the remuneration of teachers and lecturers, and the accumulative collection of books, instruments, apparatus and illustrative models and specimens.

1554. Do you think it desirable that the pupils should themselves contribute to sustain the establishment in which they are instructed?—I think so; and therefore I have brought this instance before the Committee, to show how it works, and how easily it might be put in practice upon a large scale, to spread this kind of information. They attach more value to what they pay something for. It would be very desirable to give them education, at a trifling cost to themselves, by a little public assistance. In some cases a further expense is entailed upon the individual members for the purchase of materials consumed in the process of instruction,

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struction, as paper, pencils and the like, or of elementary books of constant needful reference; but such extra expenses are incidental to all plans of instruction. The great burthen on the resources of these establishments is commonly the erection or rent of buildings; the larger establishments have, for the most part, found themselves under a necessity of building, in order to adapt the premises to the purposes of the institution; this has been almost invariably the case where a theatre has been required, and in such instances rent, interest and liquidation of debt absorb a large proportion of revenue. Were the buildings and endowments now nominally devoted to the eleemosynary instruction of the people appropriated to the diffusion of that kind of profitable knowledge for the attainment of which mechanics' institutions have spontaneously sprung up, and were they subjected to the control and management of those whose interests coincide with the judicious and honest administration of them, the rational, wholesome, effective education of the people might be effected at a cost which the country could not feel, aided by the contributions of the scholars, so trifling that no class would feel them as a burthen. The methods of instruction adopted in the mechanics' institutions are usually by periodical lectures, by schools superintended by masters, by classes for mutual instruction, by reading-rooms, and by libraries for circulation. It is only in the larger establishments that the system of lecture instruction can have a permanent character; in the smaller ones the lectures are delivered in sessions of longer or shorter term, or sometimes only in casual courses. In the London Mechanics' Institution lectures are delivered twice a week during the whole year. From the miscellaneous pursuits of the members of these institutions, it would be inappropriate to pursue any one branch of study through a long series of consecutive lectures, like the academic courses; the courses therefore are short, and calculated by illustration to facilitate the progress of students in their private labours. For lectures of this character the larger institutions are generally enabled to compensate the services of men ranking high in science and literature. The schools are distributed into distinct branches, so that only one object forms the pursuit of each; they are superintended by a master usually receiving a salary for his services. The branches of study followed in the schools are those which call for the more continuous application of the student under the guidance and correction of a proficient. The classes for mutual instruction are commonly made up of such as, having made a certain progress in any inquiry, are qualified, by a little extraordinary application, to compose lectures or essays, which they do in turn, and read to the class, which subsequently discusses the matter of the essay or lecture. In these classes many of the more important subjects of investigation, such as those of mechanical and chemical philosophy, are prosecuted more at length and examined more in detail than they can be in the condensed course of lectures publicly delivered on the same subject. The branches of instruction cultivated in mechanics' institutions being appointed, as it were, by the students themselves, may be assumed as indicative of the necessities experienced by the majorities of those classes of the community which have coalesced for the formation of seminaries for their own use. The training for the workshop and for the study are essentially distinct. Our public free-schools recognize no difference, and have been modelled on the monastic institutions, which had for their main end the qualification of men to converse of and with the dead. Our engineers, our smiths, our carpenters, our draughtsmen find no assistance in the dead languages; they covet to know the principles of science which may guide and correct their judgment, and to possess the elements of art, which may shorten their labour, and give the stamp of mastership to their works. In pursuing the course pointed out by the experience of their own wants, they have founded for their own use lectures, schools and museums, to teach them the principles and facts of mechanical and chemical philosophy, and to initiate them into the practice of the arts of design. With these guides, and after such preparatory discipline, they know that they shall become more skilful constructors, more ready contrivers, more expert workmen and more tasteful designers; their works will have more solidity, more fitness and more grace. Already numerous instances might be selected from the students in these schools, whose talents therein drawn forth have raised the individual higher in the social scale, and have stamped a national value on the system which had given them birth.

1555. Can you supply the Committee with any statement respecting the number of pupils in the London Mechanics' Institution; also an account of its funds and expenditure; the number of instructors, and the usual details which are laid before

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before such institutions annually?—I can furnish to the Committee those particulars.

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[*The Witness delivered in the same.*—Vide *Appendix*, No. 3.]

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1556. What proportion do the pupils attending the schools of design bear to the pupils generally attending the Mechanics' Institution?—They are obliged to go out after attending a certain number of courses, to make room for others. I think there are five classes of drawing schools.

1557. Do you know how many working mechanics belong to the London Mechanics' Institution?—I should think not above one-third of the number; the average number is about 1,100; our number has been stationary at that for some years; and I should think one-third of them may be called mechanics, for there are a vast number in London who are in some way or other connected with arts of production that are not strictly mechanics. There are a great number of clerks that form part of the members; and particularly law clerks, for we are just in the centre of the law establishments, and we have a vast number of lawyers' clerks among them.

1558. What portion of the instruction do they attend?—They take what courses they please; they all follow their own inclinations as to the classes they will attend; they make application to the secretary, saying "I wish to attend the drawing class," or any other.

1559. How do you account for the circumstance that the number of pupils attending has been stationary for so long a time?—That seems to be the average supply within the range of the institution; they cannot come a great distance, though we have some few whose zeal brings them from the outside of the town; but placing your building at any one point of London, you will range within a certain circuit, and that circuit appears here to have furnished very steadily 1,100 members. There are other establishments about London differing a little in character.

1560. Are there any other mechanics' institutions in London?—There are several that have emanated from that; some of them for classes considering themselves rather higher in the scale of society than those for which the London Mechanics' Institution was originally formed. For instance, there is the Western Literary and Philosophical Institution in Leicester-square, which has been going on very flourishingly. There is a more recent establishment in Mary-le-bone, of the same kind, which is called the Mary-le-bone Literary and Scientific Institution. There is another, near Finsbury, called the Mechanics' Hall of Science. There is the Mechanics' Institution in Spital-fields, which has flourished less than one would expect in a manufacturing district; the wages have been very low there; and that institution, though it began under very favourable auspices, has been always drooping, scarcely keeping itself in existence. There is another in the City, the City of London Literary and Scientific Institution. There is one at Islington, and another at Stepney. There is another recently established at Stratford. There was one in the Borough, but I am not certain whether it is still in existence; I rather think not. There is one at Wandsworth, and there was one at Deptford, but whether that is continued since the change in the Dock-yard there, I do not know; it was a good deal supported by parties connected with the Dock-yard.

1561. Have they increased much in number of late years?—They have increased in number, and those which I have mentioned are tolerably stationary as to the supply of members; that is, they have a sufficient number to keep themselves in full activity.

1562. Has the number of pupils increased much?—I should think they are pretty stationary as to numbers.

1563. Are they all upon the same system?—No, they are not upon the same system; they have each adapted themselves to their peculiar views; some taking different classes of society, and they have adapted their pursuits to the wishes or wants of the particular class forming the society. Some will pursue more literary subjects, others matters of science or matters of taste; music forms a leading object with some of them.

1564. Do they all afford more or less instruction in arts connected with manufacture?—They all, I believe, afford instruction in drawing.

1565. Can you give the Committee any details as to the number of pupils in each?—Not of those other institutions, without a special application to them.

1566. How far do you consider a knowledge of the arts of design to be important

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portant to artisans and manufacturers?—Whilst a knowledge of the principles of mechanical science is indispensably necessary to the successful execution of all works of construction, and consequently to the engineer, the builder, the carpenter and the mechanist, it is an essential part of his education to acquire it; chemical science is not less imperatively called for by equally extensive classes of operative men in innumerable departments of manufacturing industry; but to a very large proportion of the individuals engaged in both branches, some practical skill in the arts of design is either absolutely needful, or would be eminently useful. All works of construction require to be preceded by a design on paper, or a proportional delineation, which is often to be done by the workman himself. Workmen in these branches must therefore be necessarily trained to the accurate use of drawing instruments, and their operations are frequently much assisted when they can express their designs by sketches made by the unguided hand. Those workmen whose province it is to shape and give form to materials, are greatly aided in their operations when they can delineate the contours of the forms they wish to impart, or can model them in a yielding matter; and their taste is necessarily improved in studying the selected forms set before them for imitation during the course of their instruction in drawing or modelling, from which improvement their works must derive additional grace and effect. Many important branches of manufacture call for careful cultivation of the eye, for the purpose of arranging, assorting and contrasting colours, which, as an affair of taste, calls for some portion of a painter's education. Other branches subservient to the luxuries, and what may indeed be regarded as the imperative wants of a highly civilized society, demand superior skill in the delineation of landscape, and even in the drawing and modelling of the human form, and of other complex figures. As any of these operations are executed with a skill and tact to satisfy the chastened eye of the professed artist, they give value and importance to the work which has received their impress, and enhance the gratification of the cultivated possessor of the commodity. Whatever partakes of the nature of ornament will only be appreciated in a refined age, as it is characterized by grace and elegance of design and by delicacy and precision of execution. But the accomplishment of these requisites implies long and careful training in the artist, to whom, during his unprofitable noviciate, it is essential that all facilities should be afforded at their minimum of expense. When we consider the immense number in this country of workmen and superintendents, to whose successful operations the principles of science are essential; of skilled labourers, artisans and handicraftsmen, to whom the arts of design and the elements of taste in the cultivated age of an opulent society are of eminent, to many of vital, importance; when we reflect that from the knowledge and skill, and ingenuity, and taste and labour of all these men combined, the country draws all which supplies the wants, conduces to the comforts, or ministers to the luxuries of society, it would seem to be an object of no mean estimation to an enlightened Legislature to provide for the careful and adequate training, as far as public institutions can contribute, of every class of skilled labourers. The formation of schools of elementary science, of academies for the arts of design, and of museums for the collection of models of construction, of specimens of skilful workmanship, and of examples of tasteful design and graceful form, cannot fail to advance, in a conspicuous degree, both the fine and useful arts of the country. Our national greatness rests on the skilled industry of our people; it must be a part of sound domestic policy to foster, by every means within our reach, the talent which gives currency and importance to our indigenous products, and draws within the vortex of British manufacture the raw material of other climes, to be spread again over the world, enhanced in value by the labour, skill and taste of British artisans.

1567. Have you ever turned your attention to the propriety of giving protection to original designs, giving a species of copyright to them?—I have considered it a good deal, and have had much conversation with manufacturers upon it. It is a subject of heavy complaint with manufacturers that they have now so little protection in their original designs; so little protection, indeed, that they feel in many cases little disposed to incur the expense of paying artists to produce designs for their particular establishments, knowing that after they have incurred that expense they are open to piracy the next day, if they produce any thing likely to take with the public. This operates prejudicially through very extensive classes of manufactures; all, in fact, where figure or design forms a prominent feature of the production. The present protection is little available; it is an expensive process

process in Chancery which very few men choose to resort to. It has been done by some houses in Manchester, but not very extensively. I believe it requires an application to the Courts of Chancery to grant an injunction against the continuation of the piracy, which is attended with some considerable expense and trouble to the applicant, and expense and trouble that are more than equivalent frequently to the object to be protected. The great difficulty in devising security to designs, I believe, is that of defining clearly what is an original design; you can so easily, by an alteration of subordinate parts, retain the character, and still it cannot be said to be a copy of that particular work. This would require a good deal of consideration by men conversant with manufactures and with art, to be able to produce a ready recognition of the original design which each individual might be entitled to claim; there are so many easy ways of evasion. The protection asked for would in general be for a very short time, as commonly those things of pattern merely are in demand for a season, and they would be satisfied if they could have only a few months' monopoly in some branches of manufacture. In other branches of manufacture, where the taste is more durable, the protection would require to be longer. It would have to be classified, and put under the consideration of a qualified Board; perhaps the whole affair might be effected by registration in an office superintended by men possessed of practical knowledge in the different branches of manufacture. It might be done at little expense to the individual seeking the protection, without the formality of a patent.

1568. Would you have the registration central or local?—I think it would be better to be central, because it would be so easy to transmit to that office the pattern desired to be registered.

1569. Would you combine both a central and a local registration?—I am not prepared to say that there are some manufactures so extensive and so peculiarly confined to a district, that you could do all for that one branch of manufacture in the district; but then again, there are offsets from those same manufactures, and those offsets would have, in coming to the local head office, as much trouble almost as would bring them to a common central office in the metropolis; for instance, in the earthenware manufacture, which has its chief field in Staffordshire, they could do all that related to the great branch of the business; but then you would find small detached portions of the manufacture situated at considerable distances, isolated from the large fields; so in printed cottons, it would be the same, and in the weaving of figured goods it would be the same. You find them distributed here and there in certain localities all over the kingdom; so that perhaps one central office would be more convenient than the having a number of local ones.

1570. In your plan of registration, would you adopt any system of marks upon the article?—I would deposit a copy in the office, which should have the official mark of its date of reception, which should be the date of its publication. I should give a claim from the moment when it was deposited in the office; then if another man could prove that he had, before that date, made use of this design, it becomes no piracy; the other has made a claim that must fall to the ground.

1571. Would it be desirable to have any stamp or mark put upon each article made by the person who had so registered it?—I think it would be well to say, "Registered on such a day, at the office, by such and such parties," and let them put it upon every piece of manufactured goods that they made.

1572. That would leave no excuse to any person that saw the article for pirating it?—None whatever.

1573. Have you any observations to make with respect to the expediency of having a speedy remedy, through a legal or equitable tribunal?—I think that such questions would be most advantageously settled by a local tribunal, as upon the Continent, and particularly in the large towns in France; they have tribunals to which all matters of this kind are immediately referred. Their chambers of commerce are local tribunals to which all matters of dispute between merchant and merchant at once go and are settled, instead of coming to the metropolis of the country. There is a Board composed of men skilled in that particular branch. That would be at once a cheap and a ready remedy. Such a court might proceed upon the decision of the office of registration; the piracy being sent up to be compared with the original design deposited there, they would at once issue their declaration whether it was a colourable imitation of such and such a design or not. That

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might be admitted as evidence before the local tribunals, to guide them in their judgment in the appeal made to them.

1574. You would not think that one decision by such central tribunal would be sufficient?—I think perhaps not, because you might have to investigate and call for the *viva voce* testimony of the parties, which would be best done in the locality where the transaction took place, rather than bring them to a distant court; I think all that would be required from the office of registration would be a testimonial as to the identity or similarity of the two things in contestation.

1575. Must not you for that purpose send up to London sometimes articles of inconvenient weight to be examined?—That would happen sometimes, but very rarely; it seldom happens that those matters of taste are very weighty.

1576. In the case of fire-stoves, and other productions of that kind, might not that inconvenience arise?—Then you come to patented inventions; but if they were merely the ornamental designs upon a casting that could be sent at no great expense, it would be sufficient to send the plate upon which the design was.

1577. Have you any further remarks to offer upon the subject of protection to the original designers of patterns?—I think it of great importance to the manufacturers of the country that a speedy remedy should be afforded for this widely-complained-of grievance.

1578. And you propose that the period of protection should vary according to circumstances?—According to the nature of the manufacture.

1579. Must not you give some power of punishment to the tribunal?—Of course there must be some power of that kind; I believe a fine would be found necessary in all those cases.

1580. Have you been induced to make any remarks upon the effect of the Excise laws upon the progress of the arts, in connexion with manufactures?—My general impression is, that where the Excise laws are in operation in any branch of manufacture, their tendency is to retard improvement in that branch of manufacture.

1581. Have they also obstructed art, as well as mere mechanical improvements in manufacture?—In the art of glass-making, I believe it is universally acknowledged that the want of improvement is mainly to be attributed to the Excise interference; they cannot make any experiments as to improving the quality of glass except under the inspection of the Excise, and it is that prohibition which forms the stumbling block in that particular branch of art. There are certain qualities of glass for optical instruments that we have never been able to reach in this country, and we are obliged to go to the Continent for them now, in consequence of the imperfect state of glass-making.

1582. Do you consider that to result from the Excise laws?—I should ascribe it to that, in consequence of its having prevented the free career of experiment in that branch of industry.

1583. How far do you think the assistance of Government is desirable, in the formation of such institutions for circulating art, or for the foundation of open galleries for the public?—I think the assistance of Government would be exceedingly useful in furnishing the buildings in which those schools were to be established, leaving the remuneration of the masters, in a great measure, to the contributions of the students. With regard to the museums, they, of course, must, if formed, be formed entirely by the Government, because to be useful they must be open; but the Government might very readily diffuse over the country museums, containing specimens of the fine arts, at a very trifling expense, by having a central establishment, in which they would have moulds from the best works of antiquity, and from those moulds they would be able to disperse casts in plaster to a great number of those establishments, so that they would be furnished at a very moderate expense through the whole country by this one establishment.

1584. Would not such a Government undertaking repay, in national advantage, the original outlay which it cost the national funds?—I think most certainly so, in improving the taste of the artists, and also in improving the taste of the community at large, for they must both be educated together.

1585. Would not such a central system of supplying objects of art be much cheaper than any other?—I think so; the Government could readily provide itself with those moulds from the original sculptures, whether they were in this country or abroad, and those moulds would supply a sufficient number of casts, in a state of perfection, for any number of museums that might be established in the country.

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Mr. *Joseph Clinton Robertson*, called in; and Examined.

1586. YOU conduct the *Mechanics' Magazine*?—I do.

1587. How long have you conducted it?—From its commencement, about eleven years ago.

1588. Has it diffused a great deal of information among the artizans of this country?—I trust it has; it has a very extensive circulation.

1589. Have you had an opportunity of observing whether there is a want of drawing among the working mechanics?—I should say there is a very considerable want of a knowledge of drawing; but I would qualify the observation in this way: It is not so much an ignorance of the uses of drawing, its intent and meaning, as a want of personal skill in the practice of it. I have scarcely ever found among mechanics (and I have had intercourse with a very great many) an instance of their not being able to comprehend perfectly any geometrical drawing that was submitted to them. It is a common saying among them, that they can comprehend any form of construction better from a drawing than from the best written description. Indeed as most of them work from drawings and patterns, it is absolutely necessary that they should be able to do so. They can read drawings, if I may so speak, and understand them thoroughly, though they cannot themselves draw; just as many a man can read and understand our best authors, who if he were himself to take pen in hand could not write a single sentence grammatically. I may add also, that I do not think it is from want of opportunities of acquiring a knowledge of drawing, or from any neglect of those opportunities, that the majority of mechanics are thus ignorant of drawing, but because they have had no occasion to practise the art.

1590. Why have they had no occasion to practise it?—It seems to me to be but a necessary result of the great extent to which division of labour is carried in this country. Every man of the working classes looks out for and studies that branch of art only by which he expects to get a living; he confines himself to that alone. Take for instance the case of any large manufactory; it does not require probably above four or five good draftsmen to keep two or three hundred men constantly at work. Of course it would be labour thrown away for the great body of those men to acquire any greater knowledge of drawing than is requisite to enable them to comprehend the designs entrusted to them for execution.

1591. Do not you think it would be of advantage to every mechanic to be able to draw?—I think it would be a great waste of time in any mechanic to learn an art that he could not turn to some practical account; and I think that it is from a conviction of this among mechanics themselves that they refrain so generally from cultivating drawing.

1592. Is not it a deficiency of the system that in that general division of labour there should not exist classes occupied in adapting the principles of design to general use?—I believe that in every trade there is a natural demand for designers, which produces as many designers as are wanted.

1593. Are those designers sufficiently instructed?—I think they generally are sufficiently instructed. I have never met in all my experience any want of talent in designing in any branch of manufacture.

1594. Have you ever had an opportunity of comparing the designs made here with the designs made in France?—Not from visiting the workshops of France; but I have seen numerous French publications of works of art, and such specimens of French art as have been imported into this country, and I do not consider that we are behind our neighbours, except in a very few branches.

1595. You do not consider that we are in general behind the French in design as applied to manufactures?—Not behind the French, certainly.

1596. On what facts do you ground that opinion?—On the proved ability of the English artizan to do any thing you can put him to as well, if not better, than any other artizan in the world, provided only you can pay him what he calls living wages for his labour, which are, unfortunately, with us much higher than in any other country; and on the fact that many of those fine designs for which the French have the credit are in reality the productions of our own mechanics. You commonly hear it said that the patterns of French prints are much superior to ours. Now it is notorious (abroad at least, if not at home,) that most of the engraved cylinders used in France are supplied from this country. A friend of mine went into a mercer's shop in Paris, and was shown there some very beautiful printed cloths; chintzes, I believe; he dropped an expression of surprise that our

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English manufacturers could not produce such elegant patterns as those he saw before him. The shopman smiled and replied, "To tell you the truth, sir, the cylinders from which these cloths were printed, came from Manchester."

1597. That applies to the printed cotton manufacture?—Yes, to that particularly.

1598. Do you mean to extend that observation to all the more fanciful descriptions of goods in which design more peculiarly enters, as well as to the cotton manufacture?—I really do not know how to limit the observation, for though the French do perhaps excel us in fancy goods, I think this is more owing to the talents of our artizans being employed in a more profitable direction, than to any inferiority of taste in them. The great object with every English manufacturer is quantity; with him, that is always the best article to manufacture of which the largest supply is required; he prefers much a large supply at a low rate to a small supply at a higher; and that even should the present profit be less from the former than the latter, because in the long run, the larger the demand, the steadier it is sure to be. I do not think this is a point which has been sufficiently considered. From the great command of capital possessed by the English manufacturer, the immense capabilities of his machinery, and the unrivalled skill and industry of his workmen, he is enabled to turn out a greater quantity of goods in a given time than the manufacturer of any other country whatever; while our wide-spread commercial relations present him with facilities of disposal such as no other manufacturer enjoys. He lays out himself accordingly to supply those manufactures that are most in demand all the world over; and those that are the most in demand among mankind at large will in the nature of things always be of the least tasteful description; that is to say, till the bulk of mankind are much more cultivated than they now are, or are likely soon to be.

1599. Do you think, that if they exercised a greater degree of taste upon the same material of manufacture there would be a greater demand for that manufacture?—I doubt that very much; the taste, such as it is, does not seem to be any drawback on the demand. You must improve the public taste greatly before you can expect to witness any material improvement in the productions of those who minister to it.

1600. How would you improve the public taste?—That is the question for consideration.

1601. Is not the public taste improved by the sight of works of good design?—Decidedly.

1602. Do you suppose, if works of good design went into the market with works of bad design, that in the end the works of good design would not be preferred?—I am not sure of that; I think the public eye requires to be educated in matters of taste, in the same way that the understanding requires to be enlightened by reading and study.

1603. Do not you suppose that the public eye is enlightened, in matters of taste, by the exhibition of well-designed works?—No doubt; the more habituated the eye is to the contemplation of beautiful forms, the less relish it will have for the grotesque, the gorgeous and the glaring, in which rude and vulgar natures delight; and hence the superiority of the educated and travelled classes in all that regards matters of taste; the same pattern which, for elegance of drawing and delicacy of colouring, would be appreciated, and, because appreciated, universally sought after in the west end of the town, would, in all likelihood, be passed over unheeded, if not contemned, in Wapping, or any similar neighbourhood.

1604. Is it not the inference from that, that it is desirable to improve the taste of the persons at Wapping, who do not so highly appreciate that which is well designed?—Most desirable, certainly; the taste of the entire public wants improving; but as regards the mechanical classes, I think they are rather before than behind the public taste in this respect.

1605. Then how do you account for the circumstance which has been stated in evidence to this Committee, that many patterns, particularly in the silk manufacture, which are brought over from France, are greedily sought for, and copied, in preference to those of our own workmen?—I ascribe the demand for French goods partly to a taste, a vulgar taste it may be called, for what is far-fetched and high-priced, partly to the actual superiority of the French patterns, many of them derived, as I have before stated, from an English source, and partly to fashion, for which you can often assign no reason whatever. A cylinder, engraved at Manchester, is sent to Lyons, and the article printed from it comes back here, and is
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very much in request as a French pattern among persons who know nothing of its history, because, of course, the person that supplies the engraved cylinder to the French manufacturer, does it upon the understanding that he will not make the pattern engraved on it previously known in this country.

1606. Then you do not admit that any actual superiority, in point of taste, exists in France?—I do not know any thing that our artizans are not capable of producing, taking this always into consideration, that the price of food in this country is such that it will not allow them to devote to many descriptions of work the same length of time which foreign artizans, with their cheaper means of subsistence, can afford to expend upon them.

1607. You have said that at the west end of the town you think there is a better taste than at Wapping?—Unquestionably; it is a highly educated taste; the best of which the country can boast.

1608. At the west end of the town, do you, or do you not, find the goods of foreign manufacture more in demand than at the other end of the town?—I believe they are.

1609. Then how do you reconcile that with the opinion you have expressed, that the English manufactures are equal in taste to the French?—That is not exactly the opinion I expressed; I have admitted that the French do probably excel us in fancy goods, but I claim for our English workmen the merit of producing many of those patterns for which the French get credit; and I claim for them also the ability to do any thing which any other artizans can do, if you will but make it worth their while.

1610. Do you then suppose that all the French goods that come here are founded upon English patterns?—Not the whole of them, but I apprehend that a great part are.

1611. Do you suppose that a great part of the fancy silks which are consumed at the west end of the town are founded upon English patterns?—Not the fancy silks; that is a branch of manufacture long peculiar to France, and which, for various reasons, is as yet but in its infancy in this country. My observations have reference to the various cotton and linen fabrics, in which the arts of design may be carried to as great a degree of perfection as in silks.

1612. Are they carried to as great an extent as in the Jacquard loom?—They are not, but they might be.

1613. With respect to various articles of manufacture, in which the fine arts are exercised, for instance, the time-pieces and figures in or-molu, the candelabra, and various articles of that kind, which are formed upon classical models of the antique, are they principally the work of English artists, or do they come from France?—I believe the greater part of them come from France; but I am satisfied our artists could produce equally good articles of that description, if we could afford or chose to pay the higher price, which would be requisite to remunerate them.

1614. Why must they have a higher price?—Because provisions, and consequently wages, are high.

1615. How comes it that we can undersell them in cotton goods?—Because machinery has here to a great extent superseded human labour, and because in the case of cotton goods there is an immense supply to compensate the manufacturer for low prices.

1616. Then there is not a demand for fancy articles of the kind mentioned?—Yes, a demand for them among the higher classes, but little disposition on the part of English manufacturers to embark in the production of them; they prefer turning their attention to things of a more ordinary description, which every one wants. It was mentioned by Mr. Toplis that in the case of a set of porcelain preparing for The King, the work was stopped in its progress for want of artists of sufficient skill. Now, I should think that was very likely to be the case, and yet I should be slow to deduce from it an inference to the prejudice of our native artists. Kings can never be numerous as customers, and no manufacturer would ever think of rearing up designers for the special purpose of supplying an occasional order from such a quarter.

1617. Then do you lay down this principle, that it is in vain to offer to the great mass of consumers works which combine with perfect manufacture elegance of design, because they would not be appreciated by them?—I think, considering the existing state of taste among the great mass of consumers, you might produce patterns so elegant that they would not sell; for instance, in the negro markets

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of the West Indies and America, which take a large supply of goods from this country, the more gaudy an article is, the more of red and yellow in barbarous combination there is in it, the more likely it is to please.

1618. Is not that an extreme case?—I hardly think so; our fabrics go over all the world. People of taste are fond of complaining of the many ugly patterns which our manufacturers are constantly sending forth, when with the same trouble, and at the same expense, so much finer patterns may be produced; but they would not do so, if they only considered how many ugly tastes our manufacturers have to cater for.

1619. Do you apprehend that the ware of Wedgwood was indebted for any of the preference shown to it to the delicate design upon it?—No doubt the elegance of the design contributed to the circulation of the ware.

1620. Has the Wedgwood ware been in general use?—In universal use.

1621. Is not the design upon that ware a classic pattern from the antique, brought from the extremities of Italy?—Some of it is of that description, some not; but it is the general character of the ware.

1622. Do not the designs which are most sought for by the great mass of consumers proceed from the excavations of Pompeii?—I doubt whether those are the designs most sought after; there is a pattern which was a long time in very general use for table services, called the "Willow Pattern;" there is nothing very classical in that.

1623. Do you suppose that, if the ware be equally good, and the design more elegant, in course of years the consumption would be greater or not?—I have no doubt that such an increase of elegance in the productions of our potteries would help to improve public taste, and to produce an increased demand for articles of a higher cast.

1624. Do you think that in the long run, that which is founded upon admitted principles of beauty, is more certain ultimately to prevail, than that which is founded merely upon the ephemeral taste of the day?—I have no doubt of it; but I think the public mind must be educated to distinguish what is beauty and what not.

1625. Do not the artizans of this country form a great portion of the public of this country?—Yes.

1626. Are not they consumers as well as producers of manufactures?—No doubt.

1627. Do not they consume the articles produced by others, as well as manufacture themselves?—Yes.

1628. Then if you educate the eye of the artizan of this country, would not you educate the eye of the public?—Yes; so far as the artizans make a part of the public; I do not mean to question that the artizans at large share in whatever degree of bad taste distinguishes the country, but I repeat that in my opinion they are rather before the rest of the community in this respect.

1629. Do you know what proportion the artizans of the country bear to the whole population?—I cannot at present state the exact proportion; probably a fifth or sixth; but whatever the proportion may be, I apprehend it matters not. I know that an impression to the effect I have just stated does exist very extensively among our artizans themselves. Nothing is more common than to hear such of them as have any thing to do with the designing or planning of works, complain of the manner in which they are constantly thwarted by the bad taste of those who employ them. The tailors have got a phrase among them which describes this feeling very exactly; they call it "working to the head," or fancy, of the customer.

1630. Are there any means of giving a proper turn to the head or fancy of the customer?—Many.

1631. What means?—I would particularize, before all others, the circulation, as widely as possible, of good copies of the best existing works of art.

1632. Do you suppose that the taste of the customers would be influenced materially by the circulation of good works of art?—Most materially; I consider that very much of the bad taste of the country has been owing to the circulation of wretched prints all over the country, and still more wretched stucco images; the country has been inundated by them for the last 50 years and more. I may observe, by the way, as not a little curious, that this inundation has not proceeded from native artists, but from Italians. It is from Italy itself, the favourite seat of the fine arts, that this flood of execrable taste has come in upon us.

1633. Do you attribute the employment of Italian designers upon those inferior works to the circumstance that the demand of the purchasers originates from a low taste in art?—No doubt they consulted the taste of their customers.

1634. Do

1634. Do you consider that the multiplication and circulation of copies of good models would have a great influence in refining public taste, and producing improvement in works of design?—An incalculable influence.

1635. Do you consider that the progress of the arts in this country is impeded by the want of protection for new inventions of importance?—Very much impeded. Inventions connected with the arts of design, of new instruments, or new processes, for example, are, from the ease with which they can be pirated, more difficult of protection than any other inventions whatever. Such protection as the existing laws afford is quite inadequate. I cannot better illustrate my meaning, than by mentioning the case of engraving in metallic relief, an art which is supposed to have existed three or four centuries ago; and the re-discovery of which has been long a desideratum among artists. Albert Durer, who was both a painter and engraver, certainly possessed this art, that is to say, the art of transferring his designs after they had been sketched on paper, immediately into metallic relief, so that they might be printed along with letter-press. At present, the only sort of engravings you can print along with letter-press are wood-engravings, or stereotype casts from wood-engravings; and then those engravings are but copies, and often very rude copies, of their originals; while in the case of Albert Durer, it is quite clear that it was his own identical designs that were transferred into the metallic relief. Wood-engravings, too, are limited in point of size, because they can only be executed on box-wood, the width of which is very small; in fact, we have no wood-engravings on a single block of a larger size than octavo; when the engraving is larger, two or three blocks are joined together; but this is attended with so much difficulty and inconvenience, that it is seldom done. From the specimens of metallic relief engraving, left us by Albert Durer, there is every reason to infer that he was under no such limitation, that he could produce plates of any size. Now the importance of such an invention will be immediately seen, when it is considered that if you could produce an engraving of a work of art with as much facility as you can produce in types a copy of manuscript, and you could work this engraving along with the letter-press, you would have works of the largest size illustrated to a degree that is now unattainable, and might multiply copies of works of art with twenty times the celerity, and at more than twenty times less expense than you can do now. No wonder, therefore, the re-discovery of this invention has been so long a desideratum. Many are the persons who have tried to accomplish it; and I know of more than one or two who may say they have succeeded. About the year 1824, a Mr. Foulis, well known as an eminent printer in Glasgow, communicated to me that he had made a re-discovery of this art; and he produced a letter from the late Mr. Roscoe, of Liverpool, upon the subject, in which that gentleman gave it as his opinion that the art had existed; and from what Mr. Foulis had stated to him, that he believed he was in possession of the secret. I introduced Mr. Foulis to two other gentlemen for the purpose of bringing this art into use if possible. We joined together, and furnished funds for fitting up an establishment for the purpose; but after some time differences arose, and the thing dropped without being brought to a conclusion.

1636. Was that in consequence of want of protection?—Principally so; there was a difficulty arose on that head. Mr. Foulis was between 70 and 80 years of age, and we were naturally very anxious that he would leave us some specification of the invention, that we might be able to work it out, to indemnify us for the expenses we were incurring. However, Mr. Foulis could not be prevailed with to give us a sufficient specification, and we never received it from him. He wished that we should take out a patent for our mutual protection; but had a patent been taken out, that would have led of necessity to the publication of the specification; and it seemed to us that were it once published, the invention would be lost as a matter of property to all concerned. I may mention that the differences I have alluded to, led to an arbitration before Mr. Bolland, now Baron Bolland, in which arbitration the question was raised, whether such an art as I have described did really exist or had existed. A great deal of evidence was adduced on this point, and a number of artists examined, and the result was, to prove, beyond all dispute, that the art had existed, and had been lost.

1637. Is Mr. Foulis alive?—I believe he is dead, and probably the secret, as far as he was concerned, died with him; but more recently, about 18 months ago, an eminent engineer in town, who was aware of the interest I had taken in this subject, came and informed me that a friend of his had made the same discovery. To put this at once to the test, I gave him from a portfolio a small

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specimen of a paper pattern, and he pledged himself that his friend would, next morning, produce a fac-simile of it in relief. The next morning he actually brought it me, done in relief, and done admirably; it was a pattern of very great difficulty, and a copy of it could not have been executed with the hand within the time, nor executed half so well. I was perfectly satisfied from this, that the art so much sought after had been once more re-discovered. The gentleman, however, not being himself an artist, was desirous of disposing of this secret. It was suggested, as before, to take out a patent; but the answer to this was, that if patented, he must then specify the process, and it would be immediately pirated in every garret in London. It was impossible, in fact, that a patent could give him any protection at all. The case of Sir David Brewster's kaleidoscope furnishes an illustration exactly in point. He took out a patent for it; but it was so universally pirated that he could not protect it, and he made little, if any, profit from an article which, if it could have been adequately protected, might have yielded him a handsome fortune.

1638. Have any suggestions occurred to you as to the best mode of protecting such inventions?—I do not know any mode by which a property in inventions of this description could be protected; what I would suggest is this, that there should be an annual public grant for the reward of such useful inventions as the patent law cannot protect. In the present instance, all that the party asked was the sum of 500*l.* for the communication of his important secret; and because there is nobody to give him this sum, he keeps the secret locked up in his breast, and very probably it may be lost again to the community.

1639. You suppose that there exist no means of protecting, and that there only exist means of rewarding such inventors?—Yes.

1640. Is your opinion against the possibility of protection generally in other inventions of art?—Against the possibility of protecting those inventions only which can be practised by such numbers of persons in obscure holes and corners, that to vindicate the property in them by legal process is impossible; you cannot prosecute a whole nation.

1641. Cannot you prosecute one individual?—Yes; you may prosecute and put down one or two, but when every body infringes, and you have to prosecute every body, your right becomes practically a complete nullity. Where could be a stronger proof of this, than the case of Brewster's kaleidoscope, which I have just mentioned? although the undoubted inventor of it, he was powerless against a multitude. It may be said, that an inventor so circumstanced, can apply to the Society of Arts, but the premiums of that society are so small, and awarded by committees of so little select a description, that the authors of really valuable inventions do not often trouble it.

1642. You would recommend, not a system of protection, but a system of reward?—In cases of the peculiar description I have mentioned, there are many cases where a patent will effectually protect.

1643. Must not you bring proof that it is an original design before a reward is given?—I think there might be a commission of learned and intelligent persons appointed, before whom an inventor might go and submit his invention without much risk of his being able to deceive them as to its originality or ability. I would have this commission empowered to reward most liberally every new invention or improvement which they thought likely to be of national benefit; and that at once, in order that the author might have every enjoyment of the fruits of his ingenuity, and be left free to exercise his talents in the production of other inventions and improvements. They should, in fact, act on the same principle as the Society of Arts, but with larger means. Many useful inventions have been brought forward through the medium of the Society of Arts. I believe that steel engraving, which has done such wonders for the fine arts, was first introduced in consequence of one of their premiums; but I apprehend that were the entire number of inventions which have been rewarded by this society compared with the number carried into actual practice, the disproportion would be found enormous; and this I attribute principally to the smallness and inadequacy of their premiums.

1644. Is not it a good guarantee for the ultimate success of an invention, that the artist appeals to the tribunal of the public for a decision upon the merits of it?—Yes, a very good guarantee for the success of the invention, but not a guarantee for the fruits of that success coming into the inventor's pocket. If an inventor can go into the market to supply the public demand, I think the public feeling is such that

that they will patronize him in preference to any pirate or interloper; but it is not every inventor who has the means of doing so, and there are many, such as amateur mechanics, who though they may have the means, have not the inclination.

1645. Would not there be some danger in interposing an intermediate tribunal between the public and the inventor; would it not be leaving too much to their judgment, and rendering the inventor too independent of the final tribunal, which ought to decide upon it, namely, its merit in the eyes of the public?—I think the occasional loss to the public would be very small, and the advantage in a general view of the matter would be extremely great.

1646. Have you ever turned your attention to the expediency of giving every advantage to our artists of seeing, without any expense, beautiful works of art?—I think they cannot be made too universally accessible.

1647. Is there any want of natural design and taste in the artists of this country?—Not at all; I believe they are equal to anything that they can be put to.

1648. Has justice been done to them in allowing them a free inspection of works of art?—I do not think it has.

1649. Is not it highly expedient that such exhibitions should be encouraged?—Highly expedient.

1650. Have mechanics' institutions had a good effect in improving the taste of the artizans?—They must have had a good effect, but I should say not so good an effect as might have been expected, or such as they are calculated to produce under more judicious direction.

1651. In what respect?—I think, generally speaking, there is a want of system in mechanics' institutions; there is no regular course of instruction followed in any of them. When a young man has attended for two or three years, the circumstance of his having so attended suggests no definite idea of what he has learned during the time, or what course of study he has gone through.

1652. You would wish for more system in instruction and greater uniformity?—I should like some systematic course of instruction, suited to the wants of mechanics to be followed. The lectures given at these institutions often embrace subjects very foreign to the purposes of mechanics' institutions. All sorts of topics are discussed, and in every variety of order; there seems to be no principle of selection adhered to whatever.

1653. Do you think it desirable that to a certain extent the nation should assist in the formation, or in the construction of edifices to be devoted to the instruction of artizans in the arts?—I should be very jealous of the interference of Government.

1654. The question does not refer to interference, but simply assistance without interference?—I should hope more from the Government's undoing what it has done in the way of obstruction to the progress of the fine arts, than from anything it can do to promote them.

1655. What obstructions do you refer to?—To the heavy tax on paper, for one thing. Drawing papers are exceedingly expensive to persons of small means, and inferior papers are often used in copper-plate printing, when but for the tax, which is in proportion to the weight, much finer papers would be used, papers better calculated to do justice to the engraving.

1656. Would not the withdrawing of such obstructions by Government be in fact an assistance by Government?—It would amount to the same thing.

1657. Instead of giving additional speed to the machine, you remove the load that obstructs its progress?—Exactly so; and I would recommend the removal of all duties upon the importation of foreign prints; and also, that the Government should do their best to induce foreign Governments to do so likewise by our works of art. The import duty into this country is small, I believe, but still it operates to a certain extent.

1658. Would you think it desirable that any national assistance should be given, as in the case of building the schools without the slightest interference on the part of the Government, but simply that where the local resident population had advanced a certain sum, the Government should assist in the completion of the design?—I should think it highly expedient that the Government should give such limited assistance for the establishment of buildings, and probably some allowance also to the professors.

1659. You think that the interference of Government is a burden?—It is too apt to lead to jobbing, but benefactions simply can do no harm. Supposing the inhabitants of a place were to come forward with two-thirds, Government might

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with great propriety, and without the least risk of evil consequence, assist with the other third.

1660. Supposing that by the residents in any given district an offer was made to contribute a certain considerable proportion towards the formation of a gallery of casts, or a public library, or a collection of works of art, open freely to all the public, you think it would be wise in the Government, without the slightest degree of interference, simply to assist in the completion of the design?—I should think it highly expedient and highly honourable in the Government to give every encouragement in that way, to promote by all possible means the establishment of museums and galleries, so that they leave the management of them to the people themselves.

1661. Is not it probable that eventually the nation would be repaid for the passing liberality of the Government?—I am satisfied of it; the more the taste of the country is improved, the more our manufactures will be improved; and the country that has the best manufactures will of course command the greatest export trade in the long run.

1662. Are there any fiscal impediments to the circulation of abundant copies of drawings about the country?—Nothing but the expense; the duty upon paper is heavy; there are duties too of various kinds which make provisions and wages higher than they need be, and there are duties upon the importation of foreign prints; I believe also that our prints are not admitted to the Continent as freely as they ought to be.

1663. Does the Excise duty on paper materially obstruct the circulation of works of art among the people?—I should think it does; it enhances the price very much.

1664. Do not you think that our machinery and our capital offer to us a new mode of circulating a knowledge of the principles of art among the people in the application of that machinery and that capital to embellished works?—I believe that if books could be more generally and abundantly embellished than they are, if the embellishments could be as readily furnished on a large as on a small scale, and particularly if designers and artists could give fac-similes of their own designs, that would raise the arts to a much higher standard than they have ever yet attained in this country; and all this I believe to be now within our reach; encouragement and protection alone are wanting. By such an art as that of Albert Durer's, the standard would infallibly be greatly raised. It would not only abridge the time, labour and expense of production in themselves, and cause works of art to circulate among the people to twenty times the present amount, if not more, but make the people familiar with works of a much higher character than they have ever been before accustomed to. By the present mode of printing engravings with the roller-press, you cannot produce above 400 copies a day, whereas you might produce 20,000 from a plate in metallic relief, with equal ease, and all excellent impressions; impressions, too, not from copies, as even the best of engravings are, but of the artist's own original designs. You cannot, by the finest engravings in intaglio, give by any means so just a representation of the works of a Raphael or Michael Angelo, as a copy of the works of Milton or Shakspeare, executed by the meanest printer, conveys of the genius of either of these great writers. An engraving, by a secondary artist, of a good painting, like an ordinary translation of a first-rate poem, is always sure to lack much of the beauty of the original.

1665. Is there any thing else you wish to state to the Committee?—I would mention one instance, to show the great importance of multiplying copies of good designs, and making them as cheap and easily attainable as possible. An ingenious mechanic in Scotland, of the name of Hunter, has invented a machine, a stone-planing and stone-turning machine; he cuts vases out with it; he will cut a large vase out in one day, hollowed and every thing complete, which would take a man a week to produce by hand. He is now fitting up a turning apparatus for the purpose of producing a large supply of vases next winter, and he wrote to me to get him copies of the vases at the British Museum and in other collections in town. I have accordingly made a collection, which I shall send down at considerable expense to him. I mention this as an illustration of the importance of having cheap copies of all our good works of art; for copies will find their way, as in this instance, where museums cannot.

1666. When you say copies, do you mean casts or drawings?—Drawings would do very well for the purpose I have just mentioned; but casts would be much better.

Veneris, 4^o die Septembris, 1835.

WILLIAM EWART, ESQUIRE, IN THE CHAIR.

William Wyon, Esq. called in; and Examined.

1667. YOU are chief engraver of the Royal Mint?—I am.

1668. You are also an associate of the Royal Academy?—I am.

1669. You reside in London?—I reside in the Royal Mint.

1670. Previously to that did you come from Birmingham?—I came originally from Birmingham; I have left Birmingham 20 years.

1671. Have you had opportunities of observing the arts as connected with manufactures in Birmingham?—Twenty years ago I was very much in Birmingham, and since that I have had occasional communication with that place.

1672. What is the result of your observation upon the subject?—The result of my observation at that time was decidedly that there was a want of proper and due encouragement to the arts, as related to manufactures in that town. My attention about ten years ago was particularly directed to that subject; and on the establishment of the Society of Arts in Birmingham, I expressed to one of the committee a strong desire, that instead of having a society simply for the encouragement of the higher departments of the arts, it would be also desirable to direct the attention of the society to that species of decorative design required in the manufactures of the town.

1673. What are the principal manufactures in Birmingham, in which instruction in art is necessary?—I would wish rather to confine myself to that particular class to which my attention has been most directed, which is principally silversmiths, or plated and brass work.

1674. What are the observations you would offer to the Committee as applied to those branches?—The principal remark is the defective state of the designs; they are obliged to have continual recourse to the works of the French. For example, when one series of designs have run out of fashion, there is frequently a want of supply for another, and they are obliged again to have recourse to the French. Some few years ago I recollect that the style that prevailed about the time of Louis XIV. was very much in fashion. Now it is changed to the modern style of the French; but still it is French that they look to, rather than originating designs of their own.

1675. To what do you attribute this use of French designs?—I attribute it to the want of encouragement and protection given to the arts in Birmingham. It is almost invariable, that those that draw for the manufacturers are obliged, for want of proper and due encouragement, to go to other departments of the art—to painting and sculpture; they become, instead of good designers for ornamental work, second, or third or fourth-rate artists in painting and sculpture.

1676. Have you had an opportunity of appreciating the knowledge of art of those persons who are ornamental designers at Birmingham?—I have occasionally, and I think it susceptible of great improvement.

1677. What are the principal defects?—Want of originality.

1678. Are they correct in their knowledge of outline and proportion?—Certainly not; they are not well educated in that respect.

1679. Do you consider that the French are superior to them?—I think they are very superior, because there is a purer style derived from the study of nature and antique sculpture; if you look at the clocks, candelabra, and all those kind of decorations, they are always more beautiful than anything we have produced.

1680. Which is the more correct, the English or the French designer?—When figures are introduced the French are more correct.

1681. Is correctness an essential ingredient in the education of an artist for manufactures?—It is very important. The taste that I should like to see would be derived from studying nature and the works of the goldsmiths of the 15th century, and works of that class; I think it would greatly improve them, if they had an opportunity; but they are generally very poor, and have not the means of obtaining access to the works that I think would be advantageous to them.

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1682. Are they educated in that which you may call the "truth" of art, meaning by that the real correctness of it?—Their education is defective.

1683. That which depends upon certain principles?—They have no certain principles to go upon.

1684. What schools are there in Birmingham for the educating of manufacturers in art?—The principal one, with the exception of private schools, is at the Society of Arts, where they have a good collection of casts from antique sculpture.

1685. Is there no school of design connected with the mechanics' institution there?—I believe there is a drawing class at the mechanics' institution.

1686. Have you any open galleries or exhibitions of works of art accessible to the public at Birmingham?—There is an annual exhibition of modern works of art, and I believe every other year of the old masters.

1687. Is that exhibition open to the public without any fee?—They pay for the admission 1s.

1688. Is the gallery of the Society of Arts accessible to all the public without any fee?—No.

1689. Is it open to persons who are not subscribers?—No.

1690. Are the greater number of the artizans subscribers?—I believe not.

1691. Is it open throughout the year?—I believe it is.

1692. Is the subscription such as that it would be a restriction upon the working classes visiting such an institution?—I think the greater facility the better.

1693. Do you think that the slightest impediment thrown in the way of any person frequently prevents him from doing that which he would do if it were an exhibition gratuitously open to him?—I think that if a museum was instituted for the class I have mentioned, it would be more serviceable if it were gratuitous.

1694. Do not you think that any fee, however small, must be an impediment to the diffusion of the arts among the labouring classes?—That is a question that requires a great deal of consideration; it appears to me, that if there is not some little fee for instruction they would not be so desirous of availing themselves of it.

1695. Are you aware that a very slight impediment existed in the admission of persons to the British Museum, the removal of which has increased the numbers frequenting the Museum?—I am aware that there was such impediment; it was simply that of signing the name upon the admission, and since that slight impediment was done away with the number of persons that have been to see the Museum has greatly increased.

1696. Is it your opinion that that increase of number has resulted from the removal of that impediment, or at least that that has had a considerable effect in increasing the number?—I think so, decidedly.

1697. Do not you think, that if your establishment were open to persons that were not subscribers to it, it might be frequented by many that might in consequence contract a desire to become acquainted with the arts so as to improve themselves as workmen?—I think it is very likely.

1698. Have you any institution in Birmingham which teaches that intermediate portion of education of an artizan which relates to the peculiar adaptation of the art of design in which he has been instructed to the trade which he has to pursue?—There is nothing of the kind, and that is precisely the defect of which I complain; I think it would be highly desirable that something of the kind should be introduced.

1699. Have you ever thought of any means of forming such an institution?—The plan which I proposed some years ago, when the Society of Arts was being established, was that there should be the kind of connexion formed which I have already mentioned, and that premiums should be given for the most successful designs for candelabra and for epergnes, and for that particular class that is most manufactured in Birmingham; if in addition to this there was a good library, containing works of an ornamental character, it would be very beneficial.

1700. Would not a sufficient premium be found in the general demand for such objects?—I think not; I think that they require emulation.

1701. Are there persons connected with the manufactures of Birmingham employed as designers?—There are a great number of artists employed as designers who are modelers and designers.

1702. Do they receive encouragement if they are ingenious and clever men?—Not sufficient to keep them to that particular department.

1703. Do

1703. Do you consider that the want of encouragement arises from the imperfection of their designs?—There wants emulation and protection to be offered to them to induce them to continue that particular class of art, instead of wandering to other pursuits.

1704. You were understood to state that there was a demand for those metallic productions, but that the designs were made in France and not in England, and that the cause was the want of instruction among those who produced the English designs?—I think the designs would be improved if the artists were better educated.

1705. Do you think that if the designs for the metallic manufactures were improved, the demand would increase?—I am certain that it would.

1706. Would not that of itself be a natural and sufficient premium for the artist who devoted his life to making designs for manufactures?—I should think it ought to be, but it does not appear to be so.

1707. A previous question was put with reference to the propriety of establishing institutions which should teach the artizan the application of the arts to the particular manufactures to which he intended to devote himself; do you think that that should form a portion of the education of an artizan?—I do, most distinctly.

1708. How would you carry into effect such a scheme?—The plan that I proposed was particularly with respect to silversmith's and brass-work. I think that if there was a museum with free access and premiums offered, so as to induce them to improve themselves in that particular branch, it would affect the manufactures, and the taste would be greatly improved.

1709. How would you create the means of producing that which you wish to be imitated?—I should create it by models to draw from, that is, casts from the most beautiful pieces of the antique, particularly casts from the works of the goldsmiths of the fifteenth century, which have not been sufficiently attended to; and by this means I see no reason why we should not have a Benvenuto, Cellini or a Flaxman, who has done more for that branch of the art than any other person, by his Shield of Achilles, and other designs of a similar kind.

1710. How would you enable them to profit by the exhibition of the models?—By drawing from them.

1711. Do you recommend any machinery of instruction independent of the exhibition?—I should have a school for instructing them in their particular branch of art. Instead of studying simply from casts of figures, although very essential, I should like to have them also study from those particular ornamental kinds of work in demand.

1712. In fact you would let them have, first a general education in design, and afterwards superadd the application of that particular knowledge of design to the particular manufacture, and the particular material upon which the artizan was to employ his labour?—Yes.

1713. Would you make that the business of early instruction?—I should begin at a very early period.

1714. You would introduce drawing into the elementary schools?—Yes.

1715. Then you would have peculiar schools applicable to the peculiar manufactures?—Precisely.

1716. You would also have galleries containing the finer works of art open to the public?—Yes.

1717. Would you make that as extensive as possible throughout all the large towns in the country?—Throughout all the large towns; but in towns such as Sheffield, and Birmingham and Manchester, they should have museums, if you may so call it, of the works that are particularly applicable to the branch of manufacture that flourishes there, independently of schools for the higher departments of art.

1718. Do you consider that the plan you have suggested of appropriating particular schools to particular branches of manufacture, would not only educate the artizan peculiarly for that manufacture, but also would have the advantage of creating a greater division of labour, and producing all the good effects of that division of labour?—I do, certainly.

1719. Have you ever turned your attention to consider the propriety of making instruction in art a portion of the education of all the people?—I think the people themselves require education in art in order properly to appreciate art, and at the present time the public are just as likely to encourage a very inferior

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pattern as anything that is really beautiful, for want of a general dissemination of taste throughout the country.

1720. Do you think it desirable in any comprehensive and general system of national education to make design to a certain extent a portion of the education of the people?—I certainly do; but the only way to educate the people in that particular class would be to have as free access as possible to works of art.

1721. Do not you think, as reading and writing are made a portion of education, and as music is made a portion of elementary education, you might also educate the eye?—It has often been a source of very great regret to me, that at our universities and at other public seminaries, the arts of design are not considered an essential part of education.

1722. Is it possible to make instruction in design to a certain extent a part of national education?—I should think it would be quite possible.

1723. Is not it the practice now in some infant schools to give the children instruction in proportion, and to exercise their eye on the subject of form?—I have not made this a subject of inquiry.

1724. Do you consider that the early elementary education of the people in art, would increase the means of applying art to the manufactures of the country?—I think of that there cannot be the slightest doubt.

1725. Do you consider that such a system would increase the demand for manufactures as connected with art?—Most assuredly.

1726. Do you consider that such a system would extend the employment of the people, by enabling them to employ faculties which they are not able to employ at present?—Most assuredly.

1727. That is to say, the supply of art would create a demand for art, and the demand for art would in its turn create a supply of art?—Yes, and the morals of the country would be greatly improved by creating a new taste.

1728. What is your opinion as to the state of art as applied to metals now, as contrasted with its state a few years ago; is there a general improvement or not?—I should say decidedly not; there is no great improvement. Chasing, which is a very important branch of the arts, is at quite as low an ebb as it was some years ago. There is no perceptible improvement within the last 20 years, and it frequently occurs that when good designs have been obtained, they have been injured by inferior execution.

1729. Is there not a great demand, in consequence of the increase of wealth, for articles of the precious metals, which are susceptible of the application of decorative art?—I believe that upon the whole the demand for manufactured works in the precious metals have increased.

1730. Is not there a great increase of demand for silver-plated goods to which art may be applicable?—I have understood that there is.

1731. What do you consider to be the epoch of the highest art as applied to metallic substances?—Unquestionably the finest bronzes in existence are derived from the ancient Greeks; but the gold and silver works of Cellini and his time are eminently beautiful; there are also remarkably fine works from Germany about the 15th century.

1732. Do many specimens exist of the productions of that period?—A great number.

1733. Was France in the 15th century at all distinguished for the application of the arts to metals?—Yes, it was, and also about the period of Louis XIV.

1734. Can you give the Committee a comprehensive view of the progress of art as applied to metallic substances?—A satisfactory answer to this question would fill a volume.

1735. What do you consider the best period of the application of art to metals in England?—I have seen very fair specimens about the time of Elizabeth and James I., the period of Charles the First and Second; there are many beautiful productions.

1736. Do not you imagine that the metal dies of Thomas Simon, in the time of Charles I. and the Commonwealth, had a very remarkable effect in encouraging the taste for art?—I should think so; the coins of Simon were very fine, and very superior to those of his foreign rivals the Roettiers; I think a very unfortunate thing in this country is the circumstance of there being no medallic establishment; we have no medals except those which emanate immediately from the enterprize of individuals, which are struck in haste and worked off without much consideration.

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tion. It appears to me that if a series of medals were promoted by the Government, it would tend very greatly to the dissemination of taste throughout the country.

W. n. Wyon, Esq.

4 Sept. 1835.

1737. Do not you think that the influence of the great circulation of the different medals struck by Buonaparte in relation to the interesting events of history, had a great deal to do with the creation of the love of art which is universally allowed to exist in France?—I do, decidedly.

1738. Do not you think that a cheap and more extensive circulation of medals among the people might be made instrumental in creating both a love and a knowledge of art?—My view has been frequently directed to that particular, and I have been also very anxious that the copper coinage should become to a certain extent historical; I should like to have recorded upon the coinage the most remarkable events, and likewise any discoveries in science.

1739. Do not you think that the infinite variety of coins that issued from the mints of Greece and Rome, with the multitudinous designs on the reverses, and their very various character, must have been an important element in the creation of the taste of Greece and Rome?—Decidedly I think so.

1740. Supposing the head of the monarch were constantly preserved, and the reverse of the coinage frequently changed to accommodate itself to the events of the time, might not such frequent changes be made very instrumental in creating and extending a better taste among the people?—I think so decidedly; but it might be attended with inconvenience to the public if the designs for the reverses of the gold and silver coinage were frequently changed, from the difficulty of identifying the legal coinage; I do not think it so objectionable in varying the reverses of the copper money.

1741. Do you think that the circulation of the money of the country might be made instrumental in creating a great demand for art among die engravers?—That has always been my opinion.

1742. Would you vary the reverse upon a coin of the same denomination, or would you only vary the reverse upon coins of different denominations; for instance, would you vary the reverse upon a shilling?—I should myself keep the gold and silver to one type, that is a type that is well understood by the country at large, and reserve the variety of designs to the copper coinage.

1743. Are you aware, that in the periods of antiquity a great variety is to be found in the silver coinage?—Yes, but I apprehend that arose from a great many small states each coining their own money.

1744. Would there be any difficulty in accommodating a great variety of design to a perfect identity of weight?—Not the slightest, the difficulty would be with regard to relief; we cannot imitate the ancients in relief, our mode of coinage would not allow it.

1745. Might not the most beautiful coins of antiquity be re-produced or imitated in the present day in coins not for ordinary circulation; would it not be possible to create coins of twenty or thirty guineas in gold, or of ten or twenty shillings in silver, which should be made legal tenders, but which should only be used to a certain limit for the purposes of circulation, and might they not be a means of advancing art?—Quite so; it is a matter which has occupied my mind very seriously of late to improve the coinage of the country by having a five-pound piece of this description.

1746. Is not it the fact, that even now our coinage is preserved in the cabinets of the curious?—Proof impressions of the coinage in fine gold and silver are sought for with great eagerness; collectors of late are much increased.

1747. Is it your opinion that if such a scheme were adopted the demand for purposes of curiosity, or for purposes of circulation would be such as to justify the expense?—Beyond all doubt.

1748. Do not you think it would be convenient to have a portable coinage of certain denominations between a sixpence and a penny?—I think a three-penny piece in silver would be very desirable.

1749. Has not the taste in or-molu ornament increased to a great extent within the last few years?—I believe it has, very considerably.

1750. Is there not a demand for ornaments of that kind now, which did not exist comparatively a few years ago?—I believe so; but I would rather not give evidence upon subjects that I have not sufficiently considered.

Wm. Wyon, Esq.

4 Sept. 1835.

1751. Are you aware that artists of the highest class have been employed in producing works of that description?—I have not observed them, sufficient to give an opinion.

1752. Are you aware that some of the houses give the greatest encouragement to artists?—Most assuredly; Rundell & Bridge, and others, employed Flaxman and Bailey, Stodhard and Howard, and other artists of celebrity, some years ago.

1753. Is there any inferiority in our highest class of artists, as compared with those upon the continent?—I think that the artists in this country are superior in most branches of the fine arts, in reference to designs for metals; Flaxman's Shield of Achilles is superior to any thing of the kind in existence.

1754. If this higher class of artists have been employed in those works of late years, how do you reconcile that with the opinion you have expressed respecting the inferiority of those works in general?—Artists of that eminence have been rarely employed by manufacturers.

1755. In those metallic manufactures, to which your attention has been directed, is good art cheap or dear?—High talent ought to be well paid.

1756. Therefore if Flaxman and the greatest artists were employed, they must have been employed for the luxuries of the few, rather than the consumption of the many?—Certainly.

1757. Is not it very desirable for the manufactures of the nation that art should be cheap?—I think so.

1758. How do you account for it, that such specimens of art existing in this country have not been copied, and that a better taste has not gradually got amongst the workmen?—They have been too limited.

1759. Is there any want of native talent for art in this country?—Most assuredly not.

1760. It only wants development?—It only wants development.

1761. If the higher class of artists had had these beautiful specimens before them of the 15th century, and others, to what do you attribute the fact of such specimens having been so little copied in the general class of productions which have been executed in this country?—I think the want of access to them. It is a curious circumstance, that occurred to me two days ago. An artist from Birmingham applied to me, asking me to put him in the way of getting designs from the French works, and I was lamenting with him the difficulty he experienced. Being himself very poor, he had no means of purchasing the works, and he had no means of copying them.

1762. Have you ever turned your attention to the want of protection to the inventors of original designs in this country?—Not sufficiently so; but I know that there is a great want of protection, and that the manufacturers have frequently complained of their works being pirated; that after having gone to a very great expense in the production of any article to suit the taste of the time, it had been pirated, and therefore it is not worth their while to employ the best artists for the purpose.

1763. Have you ever peculiarly directed your attention to the best remedy for this evil?—No, I have not.

1764. Has your attention been at all directed to any prompt and economical means of giving and securing a copyright for designs in metallic substances?—I can hardly say that it has, sufficiently to give an opinion.

1765. Under the present system, does not a difficulty arise not only from the extent of the piracy, but from the expensiveness of the protection, wherever it is given by the law?—I have always heard that there was great complaint of the want of a summary remedy.

1766. Are you aware of the fact that there is a strong feeling as to the inefficiency and the expense of the legal remedy as it now stands?—I am.

1767. Do you think it would be easy to create an efficient tribunal, competent to distinguish what is copyright, and prompt and inexpensive in its decisions?—I think it might be done.

1768. Would not it be easy to create a tribunal in which artists themselves might be called in as judges?—I should think it would be.

1769. Would there be any great difficulty in deciding the fact of copyright in matters of design?—I should think not.

1770. And even though there might be some difficult cases, is there not a very great number of piracies which could be at once recognized as piracies and punished as such, if a competent tribunal were established?—I think so, if the tribunal was not expensive.

1771. Would

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Wm. Wyon, Esq.

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1771. Would it be desirable, in your opinion, that the copyright should last long, or would you only give it a transitory recognition?—I should think for that class of productions a very temporary recognition would be required, because the fashion varies so much that it would not be necessary to extend it to a long period.

1772. What period of protection do you imagine would be sufficient in ordinary cases?—Not more than five years, I should think.

1773. Do you think the duration of the protection should vary according to the nature of the article to be protected?—I think so, decidedly.

1774. Do not you think, that in addition to the present protection offered to works of art being tardy, costly and vexatious, the tribunals at present established are in addition incompetent to make fair decisions?—With regard to the incompetency, I think it is very likely that the decisions are generally just, but it is impossible to obtain summary justice.

1775. Would you think the Privy Council a fit tribunal to decide upon the priority of the invention of a work of art?—Certainly not.

1776. Or the Court of King's Bench?—Certainly not.

1777. Or the Court of Chancery?—Certainly not.

1778. Have you ever considered to what extent protection should be given to works of art; whether it should only be given to an original design, or whether to a combination from a previous model?—That is a question which I would rather consider before I answered it.

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APPENDIX.

Appendix, No. 1.

LETTER from Mr. Skene on the subject of the EXPOSITION of ARTICLES of
MANUFACTURE in *France*.

My dear Lord,

25th November 1829.

IN answer to your inquiries relating to the recent establishment in France, of what is there styled "The Exposition of National Industry," I beg to send you my notes on the subject, if you should find time and patience to peruse so dry a detail.

Having had occasion to witness the last display of that kind in Paris, I felt strongly impressed with the advantages which appeared to result from it; in exciting a general interest amongst all classes of society in that country in the advancement of industry, and in the progress of improvement, as well as in ascertaining the actual state of the productions, and exercise of all the multifarious branches of manufactures, and of mechanical ingenuity. At present the scheme is highly popular in France, as every thing which affords subject of national exultation is likely to become in that country; and particularly in this case, where the assembling from all quarters and the public display of the most successful performances only, in the different branches of manufacturing industry practised in the country, places their skill and success under so favourable a comparison with that of neighbouring nations, whose exportation productions (not always the most perfect) naturally become the subjects of comparative judgment. And this circumstance itself is to them a source of advantage, as the conviction of successful rivalry which it creates, stimulates to increasing efforts, in order to render the victory thence supposed to be attained over their rival, more and more triumphant. During the continuance of the Exposition, the merits of the various productions become the subject of general discussion and interest, and the names of the most skilful competitors are enumerated with pride; while every one engaged in the prosecution of any branch of industry, or possessing aptitude for invention, here enjoys the advantage of inspecting freely whatever has been most successfully achieved in any branch; he also gains valuable information, or perhaps possesses himself of a hint which may be improved into important discoveries. And thus, while the public becomes essentially benefited, the manufacturer and expositor of every class obtains the most advantageous promulgation of his individual merits, and secures to himself a reputation for skill and proficiency in his particular branch of trade, which is likely to prove to him substantially beneficial; others are here enabled to ascertain the most fitting quarters in which connexions in trade may be formed; and in all, a spirit of emulation is excited, which is the sure earnest of rapid improvement, and is, perhaps, the best security against the continuance of imperfections or slovenliness of work among the competitors for employment in every branch.

But this extent of attraction and benefit, which, under existing circumstances attends the scheme of exposition in France, is not likely to be the consequence, to its full extent, of similar attempts made elsewhere. France having recently set forward on a new course of industry, enterprise and emulation, sharpened by the characteristic energy of its people, and by their love of novelty, now displays as great vehemence in pursuit of the peaceful laurels of industry as a matter of pride as well as of profit, as ever she did for those of territorial conquest; and the public is, consequently, ready to embrace whatever is pointed out as likely to feed its appetite for national exultation. France possesses an advantage likewise in the extraordinary accumulation and variety of the products of industry and invention which are freely poured in from all quarters, but which, in almost any other country, would probably be yielded with reluctance and diffidence; and among them are presented many objects of so frivolous a description, that elsewhere they could only excite ridicule, and occasion the fastidious to withhold their more important products from forming a part of such an assemblage; whereas in Paris, such eccentricities and trifles are good-humouredly placed to account of the exuberant fancy and genius of their nation; and if they excite a smile, it is that of admiration and not of ridicule. Nevertheless I feel satisfied, that even at the advanced stage of manufacturing skill to which this country has attained, and in spite of the habitual disposition of its industrious classes to persevere in the steadfast course of their practice, whatever it may chance to be, which is recommended by long experience; and in spite of the reluctance they generally show to bestow a thought on what bears the suspicious character of novelty, some useful hints towards the encouragement, improvement and the means of stimulating exertion by honorary rewards, might be borrowed from the French system. Viewing it merely as an extension

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Letter from
Mr. Skene dated
25 Nov. 1829.

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of the plan which has been so long and (although upon a small scale) so successfully pursued by the Board of Trustees, and as an endeavour to accommodate the encouragements intended by that plan, to the progressive change which time brings about in the character and objects of industry, its being merely an enlargement of this existing plan, might serve to elude the difficulties and more easily to overcome the reluctance, which would otherwise be probably opposed to any attempt of an entirely new character. I shall, therefore, point out the particulars of the French system, from which your Lordship may judge how far any portion might be attempted here with the prospect of advantage.

The idea was first started in France in the year 1814, since which time three successive Expositions have taken place in the lower galleries of the Louvre at Paris, the last of which, in the close of the year 1827, I had an opportunity to witness. They have been now fixed to take place periodically every fourth year, under the sanction and personal inspection of His Majesty, who takes great pleasure in witnessing the display and in distributing the prizes. The more immediate management is entrusted to a board of twenty-two persons, under the presidency and superintendence of the Minister of the Interior, and is composed of an union of men of rank and influence, with a proportion of persons conversant with the sciences and manufactures. The view of engaging a minister of the Crown in the direct management, is for the purpose of being authorized to call upon the active employment of the local authorities of the different provinces of the kingdom to promote the objects of the establishment.

These local authorities are accordingly enjoined, by an official letter, to point out the advantages afforded to the manufacturing classes by the Exposition, to stimulate their enterprise and to encourage them to prepare objects for competition,—to remove any obstacles which may impede these efforts,—to prepare a suitable receptacle for goods or inventions offered for exposition,—and to appoint a jury of skilful persons to inspect the objects offered, and judge whether they are worthy and proper to be forwarded to the Exposition, and without whose sanction they cannot be received,—to see that, in the exercise of this scrutiny, the jury do not reject such articles as may be of a coarse and ordinary nature, provided they be of a description conducive to utility or to a reduction in the ordinary price of such commodities,—to rouse the emulation of manufacturers, and instruct them that the Exposition is by no means confined to articles of novelty, but extends to every display of increased proficiency whatever, in matters of national industry.

All expenses in the transmission and return of the articles are paid by the board, so that the local check and examination becomes important in preventing useless transmissions and unnecessary expense. Every object must have a number and local mark attached to it, to be entered in a schedule circulated to the provinces for that purpose, and returned to the board prior to the transmission of the goods. The expositor has likewise to accompany his transmissions with a written detail relative to the articles, and some account of his manufactory, in which he may insert any observations he is desirous to promulgate; all which being printed and circulated at the expense of the board, becomes an important advertisement for the manufacturer. He is, moreover, invited to state any means of encouragement which he conceives might be beneficially extended to his line of business.

There is no limitation as to the description of objects entitled to admission at the Exposition, provided they are instrumental to the advancement of arts and manufactures, and do not interfere with matters more adapted to compete for the recompenses of literary and scientific societies; even inventions of a description which do not admit of a specimen being exhibited, may, upon authentic certification, be publicly recorded at the Exposition, and entitle the owner to reward. In fact, it is a general display of national industry and genius, to which every one is admitted to present his best endeavours towards proficiency of any kind, in the useful and elegant arts, and to receive the reward due to his success.

So soon as the arrangements of the Exposition are completed, small committees of the board, with the assistance of persons of practical experience, are appointed to inspect the different classes of objects, and to give in their report, suggesting the objects most deserving of commendation, and the persons to whom honorary medals of different values or sums of money ought to be awarded. The selected objects are distinguished by a ticket, and the Exposition is thrown open to the public, under regulations which ensure the safety of the articles exposed and their convenient inspection.

A division into classes is observed in the arrangement of the articles, of which I shall state the general character, and add such observations as may occur to me relative to any of them.

- 1.—Wool of different qualities and dressings, in whole fleeces,—the premium dependent on the amount of stock, combined with the quality.
- 2.—Woollen yarns of different textures, stating the nature and extent of the proceeding followed in the manufacture of them.
- 3.—Woollen cloth of every kind, from the coarsest fabric to the best superfine broad cloths, under their distinctive names, and describing their particular merits and uses.
- 4.—Cashmere shawls, and others of many different materials.

5.—Silk

- 5.—Silk stuffs of every quality and description, such as satins, velvets, crapes, gauze, embroidered silk, taffetas, bobbin-net, ribands, fringes, &c.
- 6.—Linen yarn, and stuffs from sail-cloth to the finest cambric, including damask.
- 7.—Cotton yarn, and stuffs of all qualities and kinds, a numerous class.
- 8.—Lace, blonde, gauze and tamboured work, with fancy embroidery, in all its varieties, in which the French excel as much in taste as they do in the comparative cheapness of their needlework.
- 9.—Artificial flowers, of which the display is most attractive and brilliant. This branch of industry so important, as affording the means of subsistence to thousands of indigent females in the higher as well as lower stations of society, is nearly monopolized by France; and yet it has to be recollected, that, not long since, Italy was almost in the exclusive possession of this valuable resource, that France took it up at second-hand; and although the general diffusion of the knowledge of design, which is the foundation of the superior taste of the French, in works admitting of its exercise, has enabled them to carry the trade of artificial flower-making to great perfection, there is no reason against its being taken up elsewhere, and an endeavour made to supply this productive resource to a very numerous and dependent class of society. A great advantage arises from the small cost of the necessary stock of materials and requisite tools; from its being beneficial, on however small a scale it may be conducted; from the circumstance that it can be pursued at home and unaided, by the class to whom the fewest resources of profitable industry are open; and that taste and fancy find here an unlimited field for their advantageous exercise. For, in all the changes and caprices of fashion, the taste for artificial flowers, as a requisite of female ornament, seems to have stood the test of every vicissitude.
- 11.—Stuffs of various materials, printed in colours, stamped and stained in a variety of ways, affording an uncommonly beautiful display, and of singular variety, in which the beauty of colour, design and pattern, stands pre-eminent in France, with the exception, perhaps, in the brilliancy of Swiss dye.
- 12.—Articles manufactured of leather of every class.
- 13.—Paper manufactured in all its branches.
- 14.—Straw hats and bonnets.
- 15.—Carpets and tapestry. In the carpet trade, much remains to be learned by the British manufacturer in the elegance and variety of pattern, as well as in the structure of loom capable of executing richer and more varied patterns. The power of the British carpet-loom is generally confined to four threads, and, consequently, to four colours; while some of the foreign manufacturers have devised means of extending the capacity of their looms to eleven.
- 16.—Painted velvet of beautiful execution.
- 17.—Wax and floor cloths, transparent blinds, and such like.
- 18.—Paper hangings, carried to great perfection, and superior to the British, although only one-fifth the expense; the piece is purchased at three francs in Paris, which costs 15s. or 17s. in England.
- 19.—Dyeing and bleaching. The art of dyeing is particularly superior in Switzerland, where a different process is pursued, and different materials used; particularly the Indian substance called Lack-lack, in the use of which the Swiss seem unrivalled, even by the French, although the latter maintain their superiority over the English. They have recently substituted the prussiat of iron for indigo, as being cheaper, and producing a more brilliant and imperishable blue. Notwithstanding the eventual profit which any discovery in this branch of manufacture is generally attended with, and which of itself ought to stimulate invention, the causes of superiority in some of the foreign dyeing processes seem a fit matter for deeper research than that process has hitherto met with; which arises probably from the unwillingness of qualified persons to undertake the expense of inquiry at their own private risk.
- 20.—Specimens of the useful minerals of the country, including the various kinds of building stones, ornamental marbles, &c. and imitation stone.
- 21.—Articles of manufacture in metals; iron, copper, brass, bronze, tin, zinc, &c.
- 22.—Wire, and objects manufactured of that material.
- 23.—Tools of all kinds, with a descriptive catalogue of their uses; a very curious display of ingenuity.
- 24.—Cutlery, and locksmiths' work.
- 25.—Fire-arms.
- 26.—Bronze, and plated ornamental goods. Here is particularly conspicuous the characteristic of French manufacture, where the agency of a superior knowledge of design is perceived operating in the most trifling matters, and diffusing a degree of elegance and taste which is exceedingly attractive.

Appendix, No. 1.

Letter from
Mr. Skene, dated
25 Nov. 1829.

- 27.—Jewellery.
- 28.—Agricultural instruments, and processes described.
- 29.—Hydraulic machines.
- 30.—Instruments, mathematical and astronomical.
- 31.—Clock-work.

- 32.—Musical instruments.
- 33.—Articles connected with chemistry.

- 34.—Colours, varnish, and wax.

- 35.—Porcelain and glass productions.

- 36.—Painting and staining glass.

- 37.—Cabinet and joiners' work.

- 38.—Typography, calcography, and lithography ; with specimens of engraving on copper, steel, and wood.

- 39.—Bookbinding.

- 40.—Miscellaneous articles, comprehending an extraordinary variety of objects of industry and invention, such as the expositor may expect either to be productive of profit or distinction to himself in giving them publicity, or likely to become a source of benefit and interest to the public. This class is, accordingly, altogether unlimited, and seemed with the generality of visitors to be the most attractive.

When a prize is awarded to a person who had formerly received one for similar productions, he receives, instead of a second medal, a diploma confirmatory of the distinction. The sanction which is thus given by continued public approval, and the publicity of the artist's skill and quality of the goods he manufactures, has been always found productive of the greatest advantage to the individual, and a successful stimulant to the industry and emulation of others.

This is perhaps the most effectual means a public body is possessed of, to urge on the advance of improvement, at the small cost of honorary prizes, the expense of giving publicity, and of removing, or abating at least, the obstacles which the unaided efforts of genius and skill may be unable to surmount, in giving the assurance to persons striving for distinction, of the regular periodical return of opportunities of exhibiting their successful efforts in any branch of industry whatever, and in furnishing skilful and enterprising individuals with the means of acquiring knowledge of the successful proceedings of foreign manufactures ; to which may be added, the procuring for the use of manufacturers and artizans, foreign patterns, with models and designs applicable to the different branches of manufacture. The production of these last objects is not in France left to the invention of manufacturers ; a distinct occupation is created out of it, from which a numerous class of artists derive their subsistence, and persons of high eminence are not unfrequently engaged profitably in this humble pursuit ; so that a rich and varied succession of novelty in patterns is placed at the command of the manufacturer, who is freed from the necessity of urging any pattern beyond profitable limits, as commonly happens in this country. A judicious selection and regular supply of patterns from this source, would be an easily acquired and valuable boon to manufacturers.

Nothing further occurs to me at present with reference to the Exposition ; and I remain,

My dear Lord,

Very faithfully yours,

J. Skene.

126, Prince's-street, Nov. 25, 1829.

To the Hon. Lord Meadowbank.

Appendix, No. 2.

RETURNS relative to the NATIONAL GALLERY.

A RETURN of the Number of OFFICERS, effective and superannuated, connected with the NATIONAL GALLERY; the Amount of their SALARIES, with the Duties and Conditions of their Appointments, and the other Situations held by such Officers.

OFFICES.	Names of the Officers.	Salary. per Annum.	Date of Appointment.	DUTIES and CONDITIONS of the APPOINTMENTS.	Other Situations held by the Officers.
1. Keeper	William Seguier, esq.	£. 200 -	March 31, 1824.	-- To have charge of the Collection, and to attend particularly to the preservation of the pictures; to superintend the arrangements for admission; to be present occasionally in the Gallery; and to value and negotiate, if called upon, the purchase of any pictures that may be added to the Collection, and to perform such other services connected with the establishment of the Gallery, as he may from time to time be called upon to do by instructions from the Lords Commissioners of the Treasury.	-- Surveyor of the King's Pictures.
2. Assistant Keeper & Secretary.	G.S. Thwaites, esq.	£. 150 -	March 31, 1824.	-- To attend in the Gallery on the public days during the hours of admission; to carry into effect and superintend, under the direction of the Keeper, any arrangement it may be necessary to make for the admission of the public, and in regard to the Artists who may be permitted to study in the Gallery, and to act as Secretary in the making of any communications, or the promulgation of any rules and regulations for the exhibition of the Gallery, by order of the Board; the whole of his duties being to be executed generally under the direction of the Keeper of the Gallery.	-- On half-pay, as a Captain of Infantry.

N.B.—The above are the original appointments; and there are no superannuated Officers.

A RETURN of the DAYS and HOURS on which the NATIONAL GALLERY is OPEN and CLOSED.

THE GALLERY IS OPEN	THE GALLERY IS CLOSED
To the Public on the four first days of each week, from 10 till 5 o'clock; and to the Artists and Students on the Fridays and Saturdays during the same hours; in both cases, with the exceptions stated in the next column.	On Christmas-day and Good Friday; it is also closed for an annual Vacation for six weeks, computed from the end of the second week in September in each year, in lieu of all other holidays, on which it is invariably open; and to furnish the Keeper with an opportunity of examining minutely into the state of the pictures, making necessary alterations in their arrangements, &c. and causing the Galleries to be thoroughly cleaned, the frames dusted, &c. &c. &c.

A RETURN of the Number of STUDENTS who have attended for the purpose of studying in the NATIONAL GALLERY in each of the last Five Years.

The Number of Students on the Books is at present 702, who are allowed to study in the Gallery at all times, during the days set apart for that purpose, as may suit their convenience. No account of their particular attendance has been kept.

A RETURN of the ATTENDANTS and SERVANTS employed at the NATIONAL GALLERY.

SITUATIONS.	NAMES of the Persons holding the Situations.	SALARY.	DATE of Appointment.	DUTIES and CONDITIONS of the APPOINTMENT.	Other Situations held by the said Persons.
1. Attendant in the Gallery.	J. P. Wildsmith -	-- 2 guineas, per week, when in attendance.	Mar. 31, 1824.	-- Constant attendance in the Gallery, to give information to the public, and to see that no injury occurs to the pictures.	
2. Ditto - -	J. Weeks - -	- ditto - ditto -	- ditto -	The same as above.	
3. Ditto - -	T. Rimer - -	- ditto - ditto -	Oct. 29, 1827	The same as above.	
4. Police Officer in attendance at the door.	J. Upson - -	-- £. 1. 4. per week, when in attendance.	Mar. 31, 1824.	-- To see that no improper persons find their way into the Galleries, and to assist the Porter in taking charge of umbrellas and sticks.	
5. Porter - -	Henry Newham -	£. 80 per annum	- ditto -	-- The usual duties of a porter, and to take charge of umbrellas and sticks.	-- Yeoman of the King's Guard.
6. Housemaid -	Martha Hirst -	£. 50 per annum	- ditto -	-- To sweep and keep clean the Galleries, stairs and furniture of the Galleries.	

N. B.—There are no superannuated Attendants or Servants.

National Gallery, }
Sept. 7, 1835. }

William Seguier, Keeper.

Appendix, No. 3.

Appendix, No. 3.

Paper delivered in
by C. Toplis, Esq.

PAPER delivered in by *Charles Toplis*, Esquire.
LONDON MECHANICS' INSTITUTION, Established 2d December, 1823.
29, Southampton Buildings, Chancery Lane.
President.—Dr. BIRKBECK.

THE Institution is established for the purpose of enabling Mechanics and others to become acquainted with those branches of Science and Art that are of practical application in the exercise of their respective Trades and Professions.

The Subscription is 1*l.* 4*s.* yearly, or 6*s.* quarterly, and 2*s.* 6*d.* entrance, paid in advance. Members may also be admitted at the half quarter. Sons and Apprentices of Members have the privilege of attending either the Evening Classes or the Lectures, at 3*s.* per quarter. The sum of 10*l.* constitutes the Donor an Honorary Member for life.

LIBRARY.

The Library for circulation contains upwards of 6,000 Volumes, treating of every branch of Science and general Literature; and the most important Reviews, Magazines, &c. are regularly supplied. Accommodation for perusing the works at the Institution is afforded in the

READING-ROOM,

From Ten o'clock in the Morning until Ten in the Evening. The Reading-Room is also supplied with Morning and Evening Newspapers, for the perusal of which the Room is opened at Nine o'clock in the Morning.

LECTURES.

Public Lectures on the various branches of Experimental Philosophy, Chemistry, the Fine Arts, &c. &c., are delivered in the Theatre of the Institution every Wednesday and Friday Evenings, commencing at half-past Eight o'clock precisely.

Single Lecture Tickets; at 1*s.* each, may be obtained on application to the Secretary.

EVENING CLASSES.

The attention paid to this truly valuable and efficient mode of improvement will be manifest upon an examination of the following List of Classes.

No. of Members in each Class.	Average Attendance.	SUBJECTS OF STUDY.	TEACHERS.	Evenings of Meeting.
73	50	English Grammar - -	Mr. R. Daniel -	Monday.
40	- -	Writing - - - -	Mr. T. Hall -	Saturday.
36	18	Arithmetic - - - -	Mr. J. Collins -	Thursday & Saturday.
20	10	Mathematics - - - -	Mr. J. Collins -	Monday.
45	40	Practical Geometry - -	Mr. H. Barnard -	Tuesday.
39	28	Drawing, Architectural, Mechanical, Perspective, and Ornamental - - - -	Mr. C. Davy -	Monday and Thursday.
26	16	Drawing the Human Figure -	Mr. H. B. Jenkins	Saturday.
12	10		Mr. E. Anderson -	Tuesday.
	12	Modelling - - - -	Mr. C. Fines -	Monday and Thursday.
30	25	Landscape Drawing - -	Mr. J. Noblett, assisted by Mr. E. Anderson	Thursday.
	40	French Language - - -	Mons. Fischere -	Thursday.
	12	Latin Language - - -	Mr. J. Robson. -	Thursday.
In last class, 50		Short Hand, occasionally.		

In addition to the above, the following Classes have been formed on the principle of mutual instruction :—

No. of Members.	Average Attendance.	SUBJECTS OF STUDY.	Evenings of Meeting.
45	38	Literary Composition - - -	Tuesday.
33	22	Chemistry - - - -	Tuesday.
45	- -	Experimental Philosophy - -	Saturday.
	30	Geography - - - -	Monday.
	32	Natural History - - - -	Thursday.
Suspended at present.		Phrenology - - - -	Saturday.

There is also a class for the study and practice of Music, the Teachers of which are paid by the Class - - - No. of Members, 90.

THE MUSEUM

Is furnished with extensive collections of Specimens, arranged to illustrate the sciences of Mineralogy, Geology, &c., as well as with suitable Apparatus and Instruments for illustrating the Mechanical and Chemical Sciences, &c. &c.

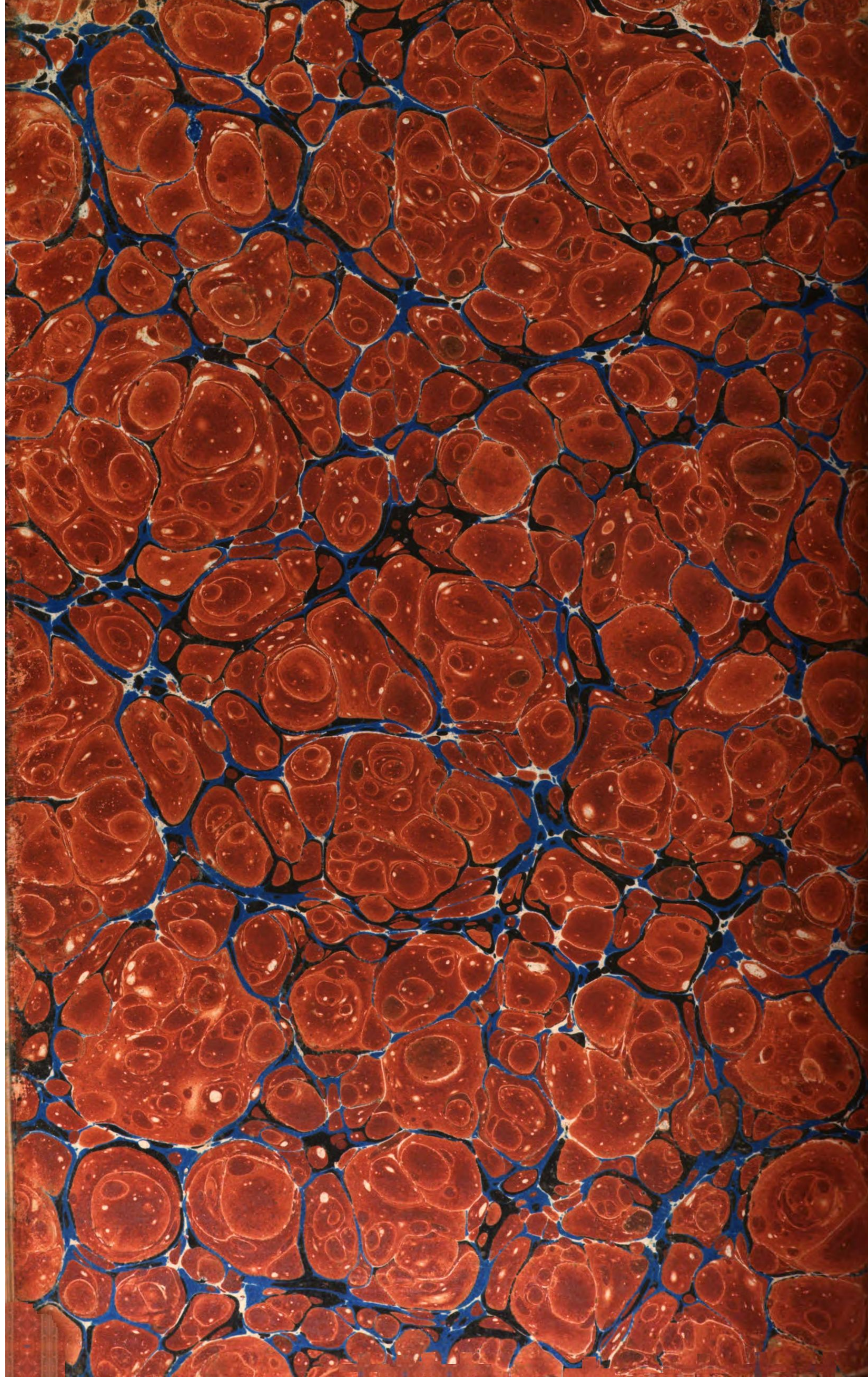
The affairs of the Institution are conducted by a President, four Vice Presidents, a Treasurer, and thirty Committee-men, elected periodically by ballot; to which privilege every Member is eligible six months after entrance.

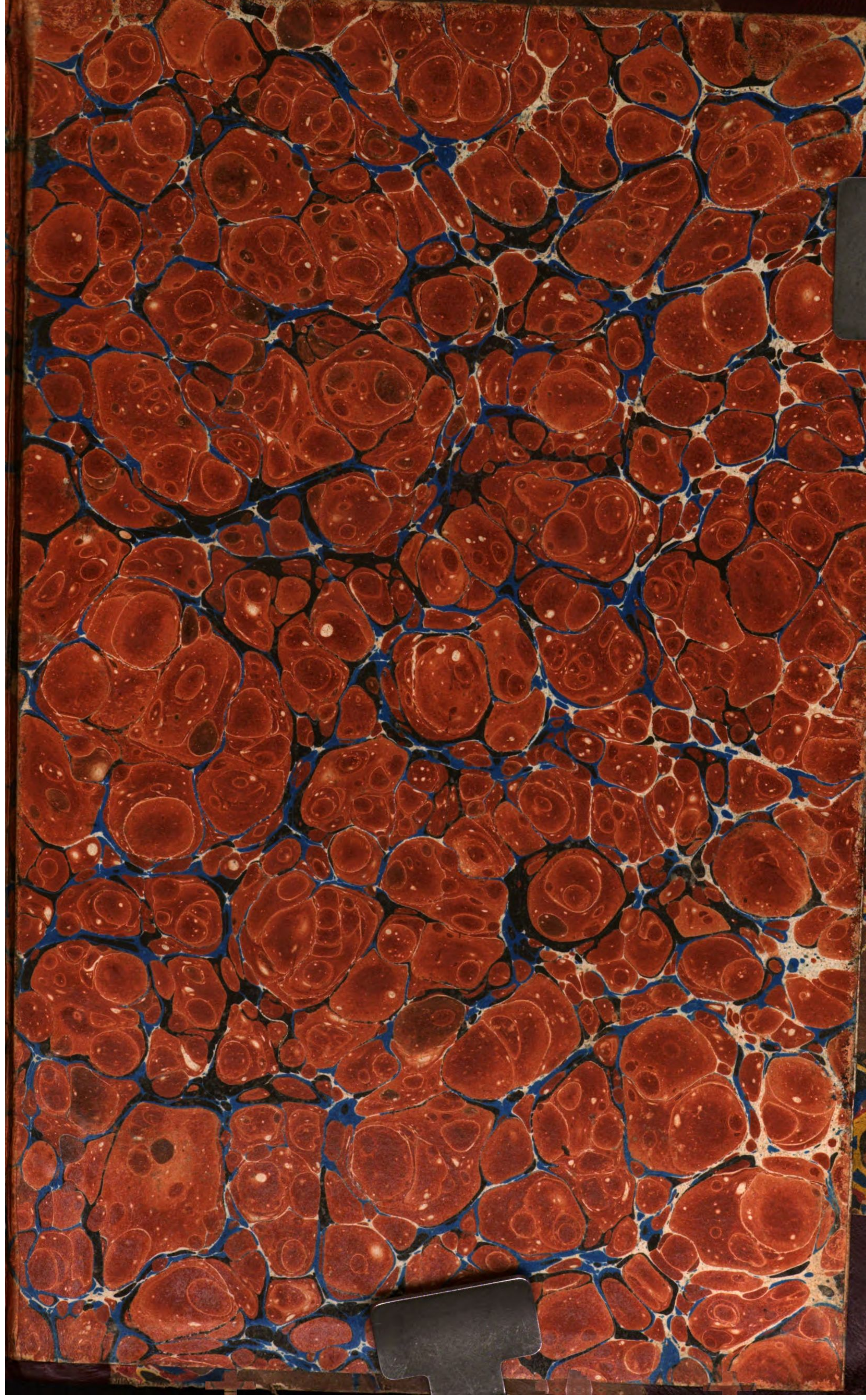
The Rules and Orders of the Institution, price 6*d.*, and the Catalogue of the Library, price 9*d.*, may be obtained in the Library.

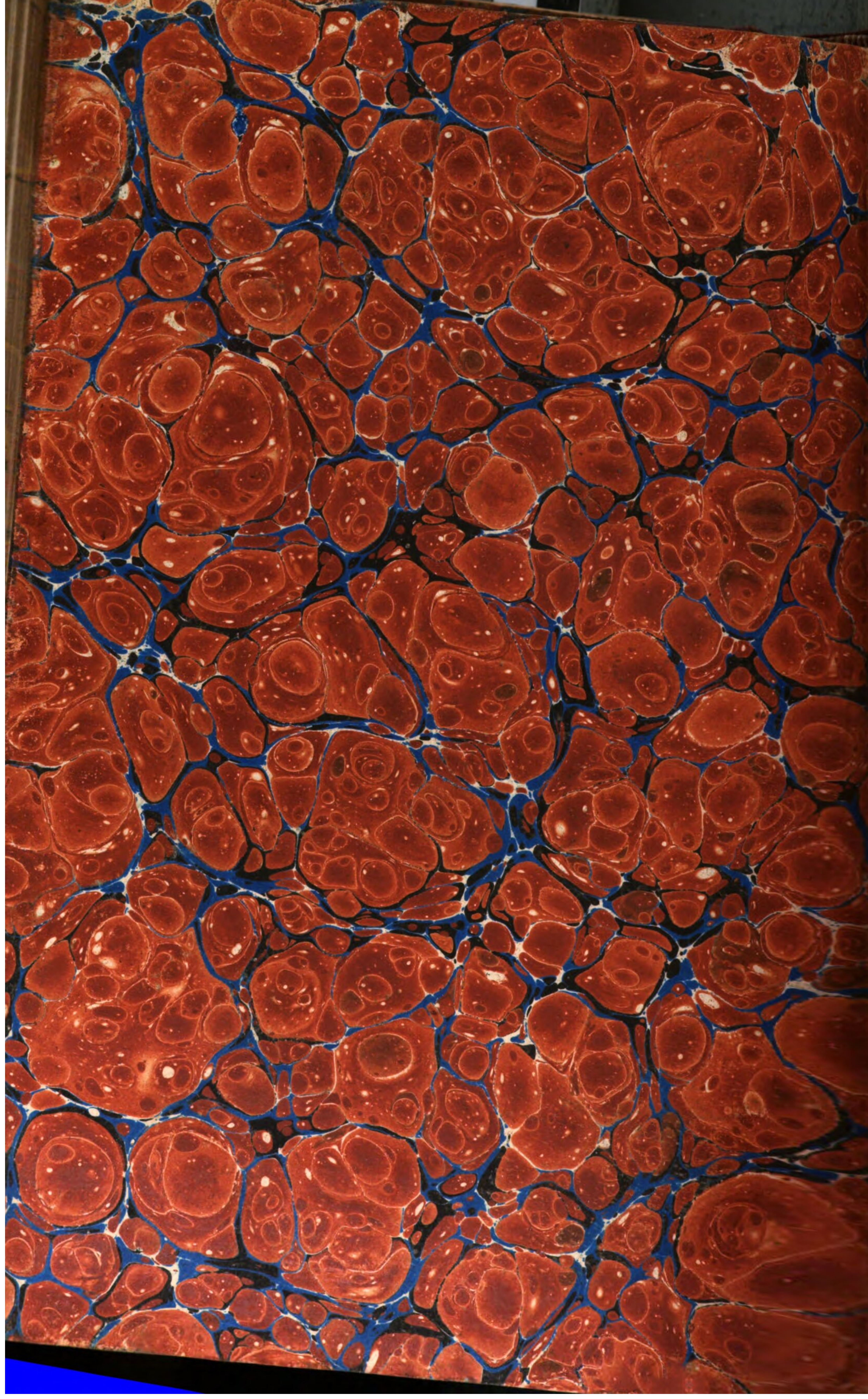
Average Number of Members for the last three years, - - - 1,069.

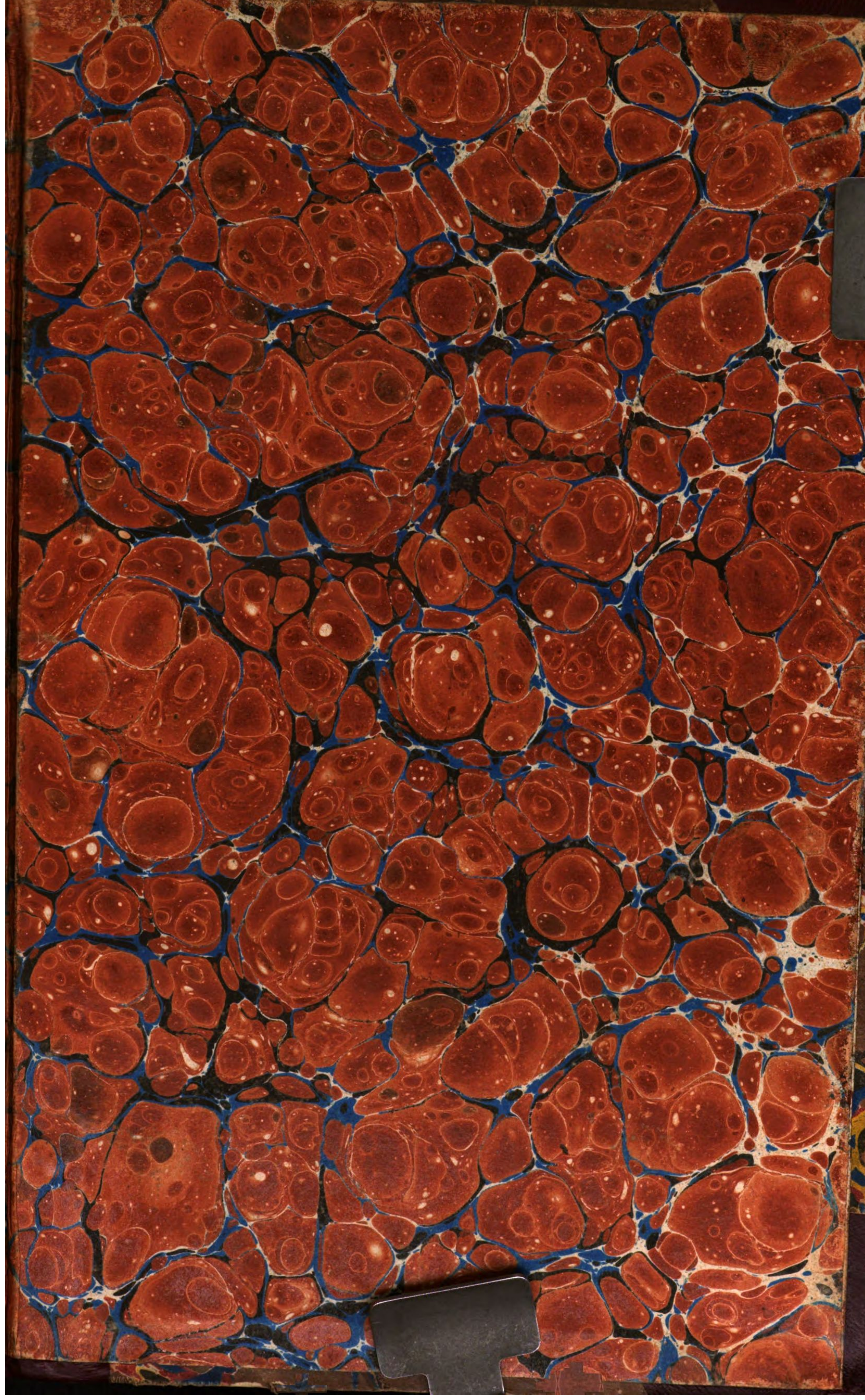
Average Receipts of Money for the last three years, - - - £. 1,640.

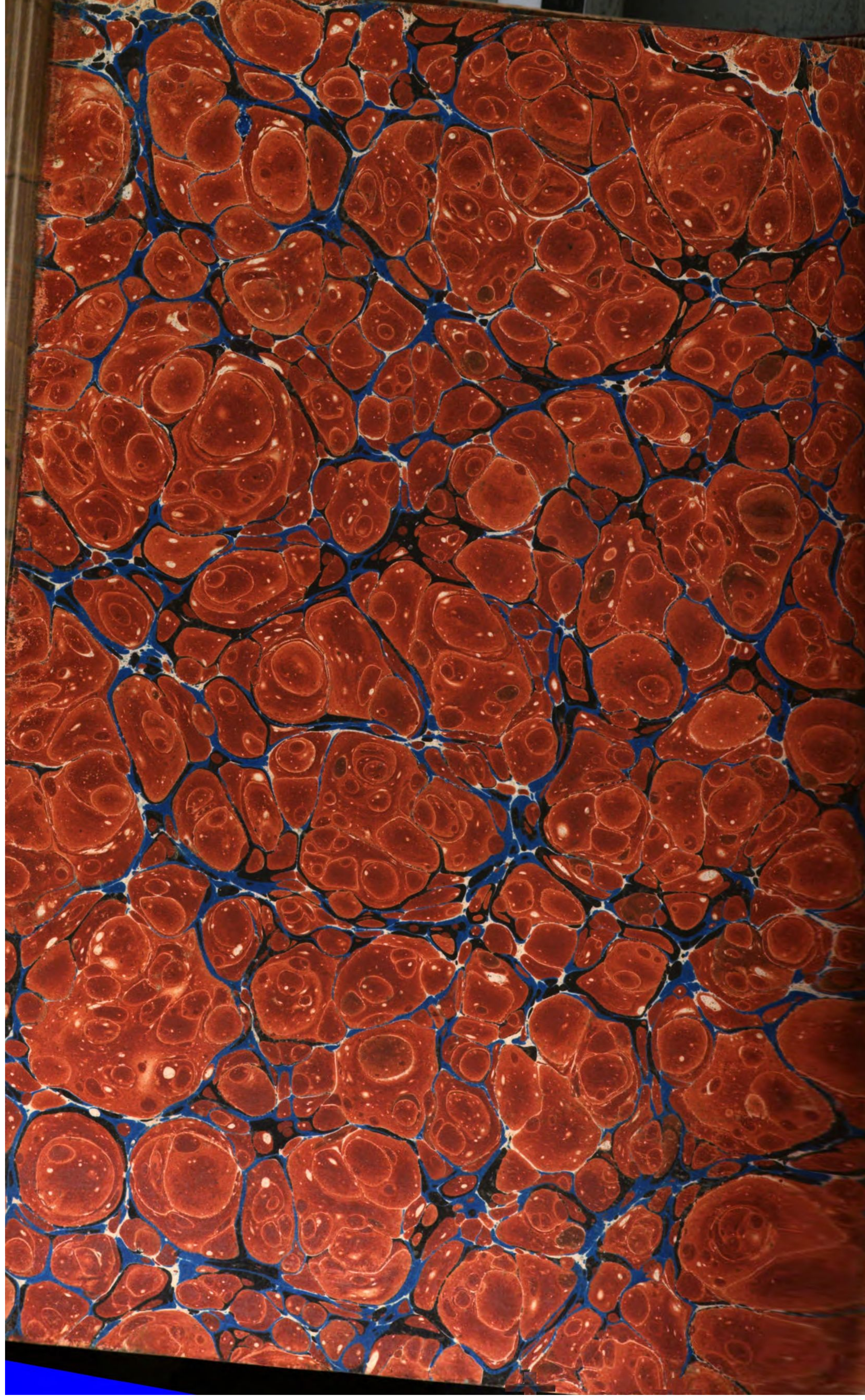
Andrew M'Farlane, Secretary.

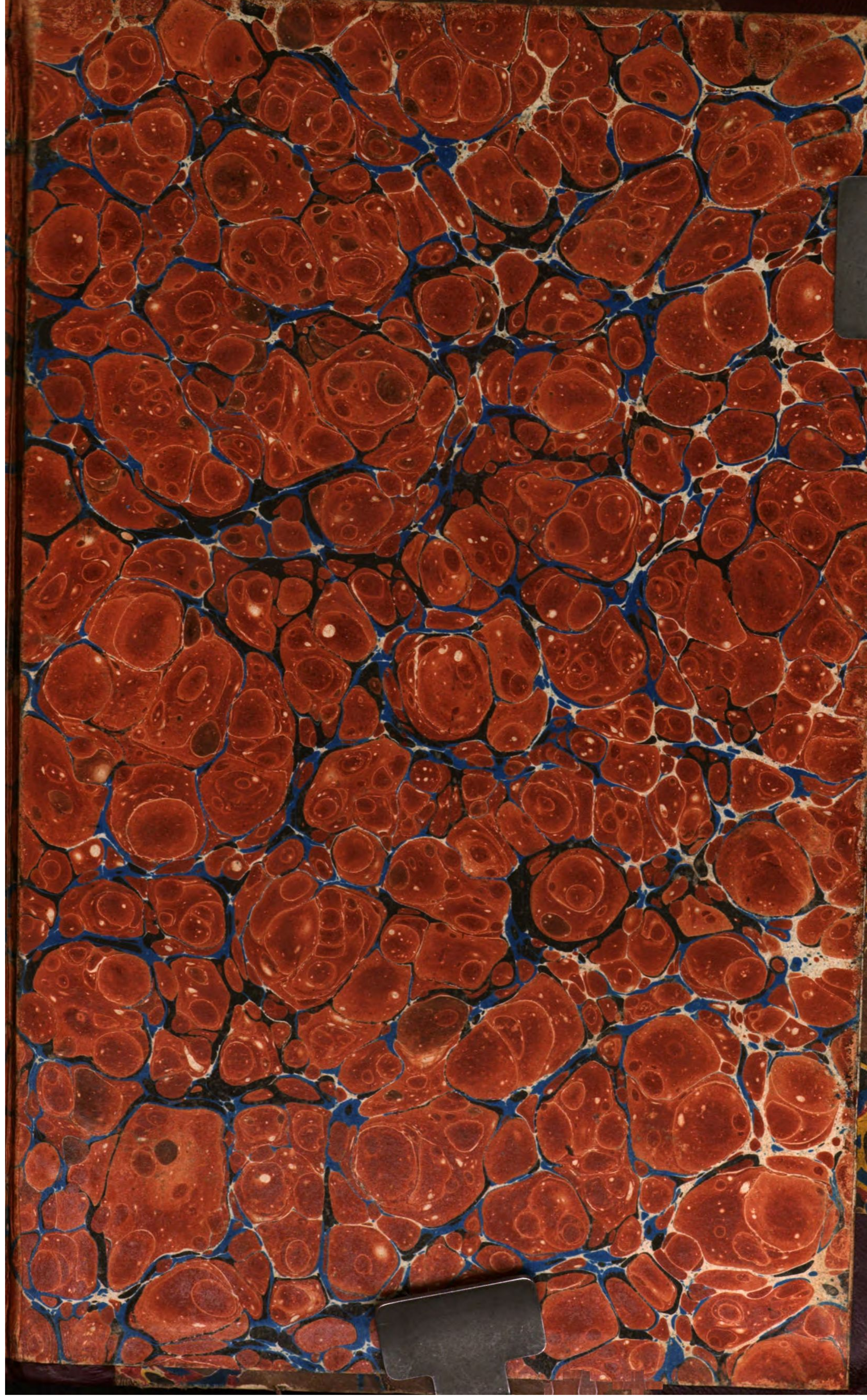














Weil, Gustav / Lewald, August / Groß, Friedrich

Selection of reports and papers of the House of Commons

Bd.: 37

London 1836

2 Brit. 92 m-37

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